The Social Competence of Children Born Extremely and Very Preterm at Age 12 Years

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Dedication

This thesis is dedicated to Susan Selway, a clinical psychologist and family friend who helped me pave my way to starting my education in my studies of psychology. Susan, a friendly, fun, loving and supportive person lost her life in the Christchurch Earthquake in 2011. She had begun but never completed her own PhD, so Susan, this PhD is dedicated in your honour.

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"A PhD student does not exist alone"

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Abstract

Background: Children born extremely preterm (EPT; <28 weeks gestation) and very preterm (VPT; <32 weeks gestation) are at an increased risk for a range of neurodevelopmental impairments compared to their full-term (FT) born peers. One important aspect of child development is social competence which significantly impacts long-term outcomes such as educational underachievement, internalizing problems, and difficulties with intimate relationships. This area of child development has not been well-studied with the preterm population. Preliminary research suggests that EPT/VPT born children experience more social competence difficulties than their term born peers, however, these existing studies are methodologically limited and have lacked a comprehensive examination of the nature of children's friendships and peer experiences, their social behaviours and their social skills. Furthermore, few studies have been concerned with preadolescence, a critical period of development for peer relationships. Finally, no studies have examined the trajectory of social development in EPT/VPT born children across childhood and few have examined predictors of and/or associated risk factors of poor social competence. The tri-component model of social competence was adopted as a research framework. This model suggests that three components constitute social competence: social adjustment (broad social outcomes such as developing friendships and getting along with peers), social performance (nature and adequacy of one's social interactions with others) and social skills (such as cooperation and relating to others).

Aims: Three studies were undertaken in this thesis to: 1) Describe the between-group differences in the social adjustment of preadolescent children born EPT and VPT relative to their FT peers at age 12 years and to identify family social background and 12-year concurrent child characteristics associated with poorer social adjustment; 2) Examine the between-group differences of the EPT, VPT and FT born children on the two lower components of the tri-component model, social skills and social performance at age 12 years and to examine the role of these components and child and family characteristics in explaining the between-group differences seen for the 12-year social adjustment outcomes; 3) Examine longitudinally the development of peer problems in children born EPT and VPT in comparison to FT born children at age 4, 6, 9 and 12 years and identify risk factors at age 4 years that may predict poor peer relationships at age 12 years.

Method: A regional cohort of 44 EPT, 60 VPT, and 109 FT born children participated in a comprehensive neurodevelopmental assessment at age 12 years as part of a prospective longitudinal study. Detailed information was gathered from child, parent, and teacher about the children's friendships, the extent of peer problems and victimization, their prosocial behaviour, aggressive

behaviour, and their social skills using custom-written or standardized questionnaires. At ages 2, 4, 6, and 9 years, children were screened for socio-emotional and behavioural adjustment problems including peer problems using the parent and teacher rated Strengths and Difficulties Questionnaire. At age 2 and 4 years, parenting styles, maternal mental health and a range of child outcomes were also assessed using custom-written or standardized questionnaires/assessments.

Results: Within the social adjustment component, parents reported EPT but not VPT born children to have fewer friends and less contact with friends than FT born children ($p \leq .02$). Child self-report showed a similar pattern although these between-groups differences did not reach statistical significance. However, 16% of EPT relative to 1−2% of VPT and FT born children reported being unsatisfied with their quantity of friends ($p = .001$). Based on parent and teacher reports, 32−37% of EPT compared with 3−8% of VPT and 8−9% of FT born children had peer problems ($p \leq .005$). EPT and VPT born children had higher odds of experiencing frequent peer-victimization than FT born children (12−14% vs. 4%, $p = .03$ and $p = .05$, respectively). Peer relationship difficulties at age 12 years were associated with lower math fluency scores and higher inattention/hyperactivity and emotional scores. Frequent victimization was associated with younger maternal age, higher body mass index, less pubertal development, poor vision, and higher inattention/hyperactivity scores.

Results for the social performance component, showed that EPT born children had poorer prosocial behaviour compared to FT born children according to teacher report only ($p = .01$, Cohen's $d = 0.5$). There were no significant differences found for aggressive behaviour between the three groups. EPT born children were reported by their parents to spend less time with friends than time FT born children spent with their friends ($p = .02$). In terms of social skills, EPT born children were at increased risk of interpersonal skill difficulties than FT born children ($p = .001$, Cohen's $d = 0.7$).

All social skills (interpersonal skills, parent and friend attachment, anxious rejection sensitivity) and two social performance variables (being a bully, and never spending time with friends) were associated with the social adjustment outcome of having peer relationship problems at age 12 years. With the inclusion of the 12-year associated characteristics (math fluency, emotional difficulties and hyperactivity/inattention) only low levels of attachment to parents and friends, being a bully, and never spending time with friends remained statistically significant in the final model.

Interpersonal skills and angry rejection sensitivity were significantly associated with experiencing frequent victimization at age 12 years, however they did not remain so after the inclusion of the 12-

year associated characteristics (hyperactivity and physical outcome variables described above) suggesting that victimization of these children is primarily a result of physical and behavioural factors. This indicates that further risk factors need to be highlighted.

Finally, using longitudinal data, parent report showed statistically significant between-group differences in levels of peer problems at age 4, 6, 9 and 12 years (all *p*'s < .02). Teacher report showed statistically significant between-group differences in levels of peer problems at age 9 and 12 years (both *p*'s < .003). Furthermore, results suggest that EPT born children show that these high levels of peer problems are stable or possibly worsening over time. Children with low cognitive ability, and high levels of hyperactivity/inattentive behaviour at age 4 years were at the highest risk of peer relationship problems at age 12 years.

Conclusions: EPT born children are at increased risk of a range of social difficulties within all components of the tri-component model. These differences include increased levels of friendship and peer problems, and frequent peer victimization. VPT born children are at increased risk of frequent peer victimization. These problems emerge early and do not dissipate by preadolescent years. This research identifies a number of 4-year and 12-year child and family background variables that were associated with poor social adjustment outcomes in pre-adolescence. Routine assessment of the social development of EPT/VPT born children should be instigated in order to identify these at-risk children and intervene as early as possible. Multi-systemic interventions are discussed in relation to individual, family, and school based avenues of addressing the social difficulties and victimization these children experience. Addressing these social difficulties prior to high-school entry may reduce the broad and far-reaching impact that poor social competence can have on these children's future development.

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List of Abbreviations

ADHD	Attention Deficit Hyperactivity Disorder
AIDS	Acquired immune deficiency syndrome
ANOVA	Analysis of Variance
ANZNN	Australia and New Zealand Neonatal Network
BASC	Behavioural Assessment System for Children
BMI	Body Mass Index
BPD	Bronchopulmonary Dysplasia
BRIEF-P	Behaviour Rating Inventory of Executive Function-Preschool Version
CBCL	Child Behaviour Checklist
CCTV	Closed Circuit Television
CELF-P	Clinical Evaluation of Language Fundamentals-Preschool Version
CI	Confidence Interval
CRSQ	Child Rejection Sensitivity Questionnaire
ELBW	Extremely Low Birth Weight (<1000 grams)
EPT	Extremely Preterm (<28 weeks gestation)
ERC	Emotional Regulation Checklist
FQQ	Friendship Quality Questionnaire
FT	Full-Term
HADS	Hamilton Anxiety and Depression Scale
IPPA-R	Inventory of Parent and Peer Attachment - Revised
IQ	Intellectual Quotient
ITSC	Infant-Toddler Symptom Checklist
ITSEA	Infant–Toddler Social Emotional Assessment

IUGR	Intra-uterine Growth Restriction
IVH	Intraventricular Haemorrhage
IYP	Incredible Years Programme
MABC - 2	Movement Assessment Battery for Children – Second Edition
MANOVA	Multivariate Analysis of Variance
MPVS	Multidimensional Peer Victimization Scale
MRI	Magnetic Resonance Imaging
NA	Not Applicable
NBW	Normal Birth Weight
NC	Not able to be calculated
NICU	Neonatal Intensive Care Unit
NR	Not Reported
OR	Odds Ratio
PDA	Patent Ductus Arteriosus
PIPPS	Penn Interactive Peer Play Scale
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PVL	Periventricular Leukomalacia
RG	Reference Group
SA	Social Adjustment
SCBI	Structured Child Behaviour Interview
SD	Standard Deviation
SDQ	Strength and Difficulties Questionnaire
SE	Standard Error
SES	Socio-Economic Status
SP	Social Performance

SPSS	Statistical Package for the Social Sciences
SS	Social skills
SSBS	School Social Behaviour Scales
TAPQOL	TNO-AZL (*Netherlands Organisation for Applied Scientific Research Academic Medical Centre)* Preschool Children Quality of Life Questionnaire
TRF	Teacher Report Form
UK	United Kingdom
USA	United States of America
VABS	Vinelands Adaptive Behaviour Scale
VLBW	Very Low Birth Weight (<1,500 grams)
VPT	Very Preterm (28-32 weeks gestation)
WISC-IV	Wechsler Intelligence Scale for Children 4th Edition
WJ	Woodcock-Johnson
WPPSI-R	Wechsler Preschool and Primary Scales of Intelligence – Revised

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Chapter Three which contains a systematic review of the development of social competence in children born very preterm was published online through the Developmental Medicine and Child Neurology journal. The article reference is:

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Please detail the nature and extent (%) of contribution by the candidate:

Kirsten Ritchie: Conceptualized the systematic review; designed the study selection criteria and search strategy; performed study selection, data extraction, synthesis, and interpretation; drafted the original manuscript; and approved the final manuscript as submitted. Kirsten contributed 75% to this paper.

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Chapter Six which contains the results of the first two aims of this thesis is currently being finalised for submission for publication through the Pediatrics journal. There is no current reference to provide.

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Kirsten Ritchie: conceptualized and designed the study, carried out and interpreted analyses, drafted the initial manuscript, and approved the final manuscript as submitted. Kirsten contributed 85% to this paper.

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A person's a person no matter how small.

– *Dr Seuss*

Chapter One

An Introduction to Extremely and Very Preterm Birth

Most parents want their child to have the best possible start to life. However, some expectant parents experience complications during the conception and pregnancy process which may put an unborn child at risk of non-optimal development. Therefore, in recent decades there have been major advancements in the practice of paediatrics and neonatology in the Western world (Heron et al., 2010; Sarnaik, Daphtary, & Sarnaik, 2005). In high income countries, improved medical care has led to dramatically higher rates of survival for those who are born much before the typical gestation period of 37-41weeks; the extremely preterm (EPT) and the very preterm (VPT) born babies (Fanaroff, 2014; Heron et al., 2010; Stoll et al., 2010; Wolke, 2011). The earlier an infant is born the more at risk they are of death, medical difficulties and long-term neurodevelopmental impairments (Blencowe et al., 2012; Saigal & Doyle, 2008; Stoll et al., 2010). However, little is known about the social development of these high-risk children should they survive the neonatal period. This thesis aims to investigate the social competence of children born EPT and VPT. In order to provide context to this thesis, this chapter briefly defines and introduces EPT and VPT birth and its known neurodevelopmental outcomes.

1.1 Definition and Prevalence of Preterm Birth

In the early days of obstetric technology (prior to 1990), medical professionals defined and diagnosed preterm birth by an infant's birthweight. During this era, very low birthweight (VLBW) infants were defined as infants born with a birthweight of less than 1500 grams and babies born early (and subsequently were smaller and had a VLBW) were subsumed into this group of infants (Wilcox, 2001). However, with the advent of ultrasound technology which allowed for an accurate estimation of the date of conception, the World Health Organisation revised their definition of preterm birth. Preterm birth is now more commonly measured by gestational age which avoids

the problems associated with confounding low birthweight and low gestational maturity (Howson, Kinney, & Lawn, 2012; Wilcox, 2001). A preterm infant is now defined as an infant born with a gestational age of less than 37 weeks, whereas a full-term (FT) infant is born after a gestational period of 37-41 weeks (Howson et al., 2012). Of those born preterm, an infant born at less than 28 weeks gestation is considered EPT; and a VPT infant is born between 28 and 32 weeks (Howson et al., 2012). A moderate-to-late preterm infant is born between 33 and 37 weeks gestation (Howson et al., 2012). These definitions have led to more accurate assessments of the prevalence of preterm birth.

In the past three decades, alongside advancements in perinatal and neonatal care, preterm birth and survival rates increased and have now stabilised (Fanaroff, 2014; Fanaroff et al., 2007; Heron et al., 2010; Howson et al., 2012; Saigal & Doyle, 2008; Stoll et al., 2010). Of all births in New Zealand, 7-8% are preterm births (Howson et al., 2012; Ministry of Health, 2012). Of these, approximately 5% are EPT births and 15-20% are VPT births with the remaining 75-80% made up of moderate-to-late preterm births (Howson et al., 2012). This equates to an estimated 1200 EPT and VPT births per year in New Zealand with high proportions of these infants surviving. Data obtained by the Australia and New Zealand Neonatal Network (ANZNN) in 2006 suggest that the survival rate of those born EPT was 79% and for those born VPT this rate exceeded 90% (ANZNN, 2009). As such, New Zealand has one of the best survival rates in the world for EPT and VPT born infants with the greatest improvements in survival rates seen in the most premature babies (Donoghue & ANZNN, 2003; Ministry of Health, 2005). International rates of preterm birth and survival are similarly high across other Western countries such as England, Australia and the United States of America (Beck et al., 2010; Chang et al., 2013). However, although there has been improvement in the survival of EPT and VPT born infants, later risks of adverse neurodevelopmental outcomes remain high and are of major concern (Stoll et al., 2010). Due to the shift in attention to the outcomes of these high risk infants, research in the area of EPT and VPT birth and subsequent neurodevelopmental outcomes is a rapidly expanding area.

It should be made clear that much of the existing research in this area has analysed EPT and VPT born children together as one sample (typically denoted as just VPT), whereas some have examined both groups separately and some have only examined EPT born children. Throughout this thesis, the sample will be labelled as per the study's method however, it is important to consider that in those studies which examine EPT and VPT born children as one "VPT" sample, any significant differences tend to be larger or occur more frequently in those EPT children born at the younger gestational ages (Blencowe et al., 2012; Saigal & Doyle, 2008; Stoll et

al., 2010). With this in mind, the next section describes the neurodevelopmental outcomes of EPT and VPT birth.

1.2. Neurodevelopmental Outcomes of EPT and VPT Birth

Research has demonstrated that compared to children born FT, children born EPT and VPT are at increased risk of a range of adverse outcomes that span health, cognitive, educational, emotional and behavioural domains. The following sections provide a brief overview of the major findings of this research.

1.2.1 Medical and physical outcomes. Children born EPT and VPT have been shown to be at higher risk of health, physical and neuroanatomical impairments (Wolke, 2014). A recent review of studies from around the world concluded that those born VPT or with a VLBW had more post-hospital complications, needed more medical care across childhood, and had more chronic health problems in adulthood than those born with a normal gestational age or birth-weight (Saigal & Doyle, 2008). As well as medical difficulties, children born EPT and VPT have also been found to be at risk of a number of sensory-motor impairments such as visual, hearing, and motor difficulties when compared to FT born children (Davis, Ford, Anderson, & Doyle, 2007; Foulder-Hughes & Cooke, 2003; Knops et al., 2005; Marlow, Wolke, Bracewell, Samara, & Group, 2005; Saigal et al., 2007; Saigal & Doyle, 2008). For example, a longitudinal case-control study by Marlow et al. (2005) found that 10% of their EPT born sample had mild to severe hearing impairments compared to 2% of their FT born comparison group. Furthermore, two longitudinal population based cohort studies found VPT born children and children born with an extremely low birthweight (ELBW) to be more likely to have bilateral blindness and difficulty seeing and hearing than FT born children (Moster, Lie, & Markestad, 2008; Saigal et al., 2007). These studies also found EPT/ELBW born children to be clumsier (Saigal et al., 2007), and the prevalence of having cerebral palsy was higher for EPT born children than FT born children (9.1% and 0.1% respectively; Moster, Lie & Markstead, 2008). In addition, children born VPT have been shown to have lower height and weight measurements across childhood and adolescence compared to FT born children (Saigal & Doyle, 2008).

Research also shows that EPT and VPT born infants are at risk of cerebral injury and altered cerebral structural development (Kinney, 2006;Soria-Pastor et al., 2009; Volpe, 2009). For example, 'encephalopathy of prematurity' is a recognised pattern of brain development seen in EPT and VPT born infants defined by periventricular leukomalacia brain injury accompanied by neuronal/axonal disease which can affect the cerebral white matter, thalamus, basal ganglia, cerebral cortex, brain stem, and cerebellum which can have an impact on a number of physical and cognitive functions (Iwata et al., 2012; Volpe, 2009; Woodward, Clark, Bora, & Inder, 2012).

In line with this, a recent meta-analysis showed that VPT/VLBW children were also found to have smaller total brain volume, white and grey matter volume, cerebellum, hippocampus and corpus callosum (Mulder, Pitchford, Hagger, & Marlow, 2009). Thus, it is clear that EPT and VPT born children suffer from a range of difficulties with their medical and physical development, but the consequences of EPT/VPT birth spread beyond physical outcomes.

1.2.2 Cognitive outcomes. Deficits in cognitive and executive functioning in children born EPT/VPT have also been indicated (Anderson, Doyle, & Group, 2003; Bhutta, Cleves, Casey, Cradock, & Anand, 2002; Moster et al., 2008; Sansavini et al., 2006; Vicari, Caravale, Carlesimo, Casadei, & Allemand, 2004). A recent meta-analysis of 27 comparative studies demonstrated that children born VPT had an overall IQ score deficit of 12 points compared to FT born children (Kerr-Wilson, Mackay, Smith, & Pell, 2012). In a prospective longitudinal study the average IQ score for VPT born children was 95 as opposed to FT born children who averaged an IQ score of 105 (Woodward et al., 2009). This study further found that 34% of VPT born children as opposed to only 13% of FT born children had significant cognitive delay (defined as an IQ score more than one standard deviation below the mean for the FT born group). These results indicate that EPT/VPT born children are at risk of cognitive delay.

Further examination into the nature of EPT/VPT born children's cognitive impairment have found specific areas of lower cognitive functioning across childhood (Aarnoudse-Moens, Weisglas-Kuperus, Duivenvoorden, van Goudoever, & Oosterlaan, 2013; Anderson & Doyle, 2004; Mulder et al., 2009; Woodward et al., 2012). Executive functioning has been found to be impaired in EPT/VPT born children according to a recent literature review as well as cross-sectional and longitudinal comparative studies (Aarnoudse-Moens, Smidts, Oosterlaan, Duivenvoorden, & Weisglas-Kuperus, 2009; Anderson & Doyle, 2004; Arpi & Ferrari, 2013). More specifically, VPT born children were found in two longitudinal follow-up studies during early and middle childhood to be more likely to score lower than FT born children on measures of verbal and spatial working memory, visual spatial processing, attention, inhibitory control and cognitive flexibility (Aarnoudse-Moens, Smidts, et al., 2009; Vicari et al., 2004). Furthermore, Edgin et al. (2008) showed in their prospective, longitudinal study using magnetic resonance imaging technology that executive functioning deficits increased with increasing cerebral white matter abnormalities present at birth. Collectively, this suggests that children born EPT/VPT, especially those with white matter abnormalities, process complex information with more difficulty than FT born children.

1.2.3. Language outcomes. Communication and language processing has also been shown to be delayed in children born EPT/VPT when compared to FT born children (Sansavini

et al., 2010; Wolke, Samara, Bracewell, Marlow, & Group, 2008). For example, a recent meta-analysis showed VPT born children performed more poorly than their FT peers on measures of expressive and receptive language (Barre, Morgan, Doyle, & Anderson, 2011). A second meta-analysis also showed that children born VPT have difficulties with complex language skills as they were three to five times more likely to experience difficulties with speech articulation and pre-reading skills than children born FT (Van Noort-Van Der Spek, Franken, & Weisglas-Kuperus, 2011; Wolke et al., 2008). Finally in a prospective longitudinal study which used a standardised measure to examine language development, Foster-Cohen, Edgin, Champion, and Woodward (2007) showed that the lower an infant's gestational age, the smaller their vocabulary size, and the lower their quality of word use, and complexity of speech. Together, these results suggest that EPT/VPT born children are likely to have difficulty understanding and expressing verbal and written communication to the same level as their FT peers.

1.2.4. Educational outcomes. Perhaps not surprisingly given these cognitive and language difficulties, EPT/VPT born children are also more likely than FT born children to experience educational difficulties. As such, all VLBW cohorts in a comparative study of four Western countries (United States of America, Bavaria, Canada, and Holland) displayed cognitive and school difficulties compared to normal birthweight (NBW) children (Saigal, Pinelli, Hoult, Kim, & Boyle, 2003). A meta-analysis by Aarnoudse-Moens, Weisglas-Kuperus, van Goudoever, and Oosterlaan (2009)) which assessed 14 comparative studies on academic achievement found that children born VPT/VLBW scored on average between 0.48 and 0.76 standard deviations lower on mathematics, reading, and spelling tests than their FT peers. More specifically, in a prospective longitudinal study conducted in New Zealand, six year old VPT born children had higher rates of below average ability in reading (31% vs 15%) and maths (47% vs 21%) than their FT peers (Pritchard et al., 2009). Similar findings were found in a United Kingdom based prospective longitudinal study of EPT born children at age 11 years which found half of the EPT born children in their study to have low academic achievement compared to only 5% of FT born children (Johnson et al., 2009). Moreover, children born EPT were found in this study to require special educational support at school due to academic or behavioural difficulties more often than FT born peers (62% versus 11% respectively; Johnson et al., 2009). These findings suggest that EPT/VPT born children are more likely to lag behind their peers at school and struggle to perform at the expected age-appropriate level.

1.3. Mental Health Outcomes

Thus far, the consequences of EPT and VPT birth that have been outlined show that EPT and VPT born children are at risk of a range of medical, and neurodevelopmental difficulties which

may make them developmentally unequal to their same aged peers. A natural progression from this research is for the literature to address the mental health consequences of EPT and VPT birth. In other words, given the neurodevelopmental difficulties these children face compared to FT born children, are they at increased risk of behavioural, emotional and/or social difficulties? The next section will outline what is known about the behavioural and emotional outcomes of EPT/VPT born children, which are the two mental health areas which have received the most investigation.

1.3.1 Behavioural and emotional adjustment. In line with the research discussed above, children born EPT and VPT have increased behavioural and emotional problems when compared to FT born children (Delobel-Ayoub et al., 2006; Reijneveld et al., 2006). For example, children who were born EPT/VPT have been found to have poorer overall behavioural adjustment across two meta-analyses (Aarnadouse-Moens, et al., 2009; Bhutta et al., 2002) and to be rated by their parents and teachers as having more attention-deficit hyperactive disorder (ADHD) problems (Aarnoudse-Moens, Weisglas-Kuperus, et al., 2009; Johnson et al., 2010b; Mansson, Stjernqvist, & Backstrom, 2014). A recent literature review found VPT born children to have poorer behavioural regulation resulting in more impulsive, disinhibited behaviour than their FT born peers (Arpi & Ferrari, 2013). In their prospective longitudinal study,Bora, Pritchard, Moor, Austin, and Woodward (2011)) found six year old VPT born children to be twice as likely (12% versus 6%) as their same-aged FT born peers to have pervasive inattention/hyperactivity problems. However, despite the high prevalence of attention and regulation related externalising disorders, increased aggressive behaviours have not been consistently found to be increased in EPT and VPT born children, a finding confirmed by meta-analysis (Aarnoudse-Moens, Weisglas-Kuperus, et al., 2009).

As well as an increased risk of externalising behaviour disorders, there is also an increased risk of internalising emotional difficulties such as anxiety and mood disorders (Aarnoudse-Moens, Weisglas-Kuperus, et al., 2009; Johnson & Marlow, 2011; Mansson et al., 2014). For example, a recent meta-analysis by Burnett et al. (2011)) showed that the risk of any diagnosis (including anxiety and depression) was increased by more than three times for individuals born VPT/VLBW compared with FT born peers across childhood, adolescence and early adulthood. In addition, a cross-sectional comparative study by Mansson, Sternqvist and Backstrom (2014) also showed that children born VPT experienced more emotional reactivity, anxiety, depression, somatic complaints and withdrawn behaviour than FT born peers during early childhood. In line with this, a prospective longitudinal study found 6% of VPT born children to experience pervasive emotional problems compared to only 1% of children born FT at age six years (Bora et al., 2011). These

findings indicate that children who are born EPT or VPT are also at risk of poor behavioural and emotional development.

1.4 Conclusion

Overall, it is clear that EPT/VPT born children are at risk for a range of neurodevelopmental difficulties throughout their lifetime ranging from low height and weight, to sensory difficulties, to executive functioning difficulties and through to increased levels of mental health difficulties such as increased rates of behavioural problems, anxiety and depression. One important aspect of child development, which has not received much attention and remains less understood in the EPT and VPT literature, is the development of their social competence.

"She has no sleepovers, goes to no parties, and is not popular with the other children"

- ***Parent of female EPT born participant (born at 27 weeks)***

Chapter Two

The Nature of Social Competence

Social competence plays a pivotal role in a child's development. Many of the skills required for adequate social interaction form the foundation for later successful social, educational and employment functioning in adulthood. General population studies show that poor social competence is associated with educational underachievement, peer rejection, internalizing problems, and school disengagement during childhood and adolescence (Buhs, Ladd, & Herald, 2006; Fox & Boulton, 2006; Woodward & Fergusson, 2000; Zwierzynska, Wolke, & Lereya, 2013). Even average social skills or moderate peer relationship problems puts children at risk of dropping out of school (Orpinas, Raczynski, Peters, Colman, & Bandalos, 2014; Woodward & Fergusson, 2000) and unemployment (Woodward & Fergusson, 2000). Furthermore, adult consequences of poor social competence include difficulties with intimate relationships, and poorer social, occupational, and family functioning (Fergusson & Horwood, 1998; Fergusson, Horwood, & Ridder, 2005; Kajantie et al., 2008; Moster et al., 2008; Reijntjes et al., 2011; Woodward & Fergusson, 1999, 2000).

Despite the influence of social competence on current and later functioning, there is a paucity of research that has specifically addressed the development of social competence of children born EPT/VPT. Preliminary research on children born EPT/VPT prior to medical care and survival rate improvements (established approximately 1990) suggests that these children will also be at increased risk of social competence difficulties (e.g. Hallin & Stjernqvist, 2011; Nadeau, Boivin, Tessier, Lefebvre, & Robaey, 2001). For example, these studies showed that children born VPT had fewer social skills and less adaptive behaviour (Hack et al., 1994), were more isolated and sensitive (Nadeau et al., 2001), and were more likely to be bullied (Nadeau, Tessier, Lefebvre, & Robaey, 2004). Longitudinal studies showed that these difficulties in social functioning persisted into adolescence and early adulthood (Hallin & Stjernqvist, 2011; Hille et al., 2001). These results,

together with the range of other neurodevelopmental difficulties which these children are more likely to encounter, suggest that children born EPT/VPT will also be at risk of social difficulties.

Social competence research focusing on both the preterm population and the general population has a number of difficulties, most notably because defining social competence is not straight-forward. Therefore this chapter briefly introduces the construct of social competence. This begins with an overview on why this field of research is methodologically weak. The chapter then provides an overarching definition of social competence based on current knowledge. Then, in order to tangibly examine this broad definition, an existing model of social competence is introduced which has been employed to provide structure to this thesis. Lastly, as this thesis focuses on children at age 12 years a description of the typical development of social competence in children during pre-adolescence (age 10 to 12 years) is used as an example in the explanation of this model.

2.1 Background to Social Competence Research

Although literature in the field of social competence is burgeoning, there is no universally accepted definition of social competence (Arnold & Lindner-Müller, 2012; Cavell, 1990; Merrell & Gimpel, 2014; Raino, 2008; Rose-Krasnor, 1997). There are widespread and differing views on what social competence is and how it should be conceptualised (Ladd, 2005; Merrell & Gimpel, 2014; Raino, 2008; Rose-Krasnor, 1997; Waters & Sroufe, 1983).There are three main reasons why the generation of a broadly accepted definition of social competence has been difficult.

1. Comprehensiveness of measurement of the construct. Some studies use a narrow definition of social competence and assess just one aspect (such as social skills) whereas other studies aim to take a global focus of social competence and for instance, include aspects as far-reaching as behavioural or emotional adjustment (Ladd, 2005; Muscara, Catroppa, & Anderson, 2008; Raino, 2008). Researchers are not often clear about their research goals and how their outcome measures contribute in comparison to the wider scope of the social competence field.
2. There is an array of social terms used synonymously by researchers. This may result from a lack of a shared understanding between researchers (Rose-Krasnor, 1997), especially those investigating social competence from different fields and perspectives (Cavell, 1990; Merrell & Gimpel, 2014). Terms used interchangeably in the literature include social skills; social interaction; social functioning; social competence; social adjustment; interpersonal skills; sociability; and socialization. These terms essentially represent different components of social competence or at times entirely different constructs altogether making summarising and interpretation of results difficult.

3. The skills and goals that constitute the construct of social competence change and become more complex as a child develops (Arnold & Lindner-Müller, 2012; Carr, 2006; Raino, 2008; Stump, Ratliff, Wu, & Hawley, 2009; Waters & Sroufe, 1983). Much like other developmental domains (e.g. cognitive development) social competence in one developmental period has a cascade of effects for social competence in the following developmental periods (Carr, 2006; Kouros, Cummings, & Davies, 2010; Waters & Sroufe, 1983). As a result, children of different ages will have different target social skills, social cognitions and social behaviours to be measured (Rose-Krasnor, 1997; Stump et al., 2009; Waters & Sroufe, 1983). For example, co-operative play is an important developmental goal in early childhood whereas in pre-adolescence an important developmental goal is maintaining quality friendships and increasing emotional bonds (Carr, 2006; Ladd, 1990). Unfortunately, the different skills and behaviours for children of different ages are not well laid out in the research nor defined within existing social competence studies. Despite the literature being somewhat disjointed, there is some general consensus about the development of social competence across childhood. With careful collation of existing knowledge in the field, social competence can be defined.

2.2 An Overarching Definition of Social Competence

Many definitions of social competence have similar underlying themes and were collated by the author of this thesis in order to provide an overarching definition of social competence. This definition was based on recent advances in knowledge yet was closely aligned with the most common definitions in the literature. Social competence is defined as *"the age-appropriate ability to be successful, flexible and efficient in social interactions in order to meet one's own and other's needs, expectations and goals of the situation which results in achievement of broader developmental goals*" (Cavell, 1990; Rubin & Rose-Krasnor, 1992). In other words, social competence refers to the ability to interact well with others at a level that is developmentally appropriate and promotes increased wellbeing and quality of life. For clarification, Table 2.1 displays a list of terms used in the social competence literature and their intended definition in this thesis. Figure 2.1 further illustrates this definition in context to the overall construct of social competence in this thesis, which is further broken down by a framework comprised of three components, described in the next section.

Table 2.1 : Definitions of Social Terms Used in this Thesis	
Term	**Definition**
Social Competence or Social Functioning	The ability to be successful, flexible and efficient in social interactions in order to meet one's own and other's needs, expectations and goals of the situation which results in achievement of broader developmental goals. Social competence is hypothesized to be made up of three components: social adjustment, social performance and social skills (Cavell, 1990; Rubin & Rose-Krasnor, 1992).
Social Adjustment	The broadest component of social competence referring to the achievement of social goals (such as maintaining quality friendships) and broader developmental goals (such as school engagement; Cavell, 1990)
Social Performance	The degree to which an individual's interactions in social situations, *at the point of performance*, meet socially valid criteria (expectations and goals) as assessed by self and others and whether it favours further positive interactions (Cavell, 1990).
Social Skills	Any skill a person possesses that facilitates healthy and positive interaction and communication with others. These skills may be directly relevant to social development (such as Theory of Mind) but may also be skills that aid performance in other developmental areas (such as verbal skills). Thus skills may be from a range of areas including cognitive, emotional, communicative, behavioural, interpersonal and social-cognitive and include internal events (such as perceiving, and thinking) as well as overt behaviours (Cavell, 1990; Rubin & Rose-Krasnor, 1992).
Social Interaction	Two or more individuals engaging in personal communication or behavioural exchanges.
Interpersonal Skills	Skills that are helpful in facilitating good social interactions between two people. For example, group work skills, co-operation, relating to others, empathy, Theory of Mind (Rubin & Rose-Krasnor, 1992; Stevenson, 2010).
Friendships	The voluntary, reciprocal relationship between two peers who care for and like each other, are intimate, share experiences and spend time with each other (Mash & Barkley, 2014).
Peer Relationships	The relationship between an individual and their wider peer group who they may engage with on a daily basis through school. These relationships have less intimacy and shared experiences e.g. classroom peers.
Bullying	The act of engaging in abusive interactions towards other children in order to hurt or cause distress. Bullying may be physical, verbal, attacks of property and/or social manipulative behaviour (Mash & Barkley, 2014; Mynard & Joseph, 2000).
Victimization	Exposure to a peer or peers who direct abusive bullying interactions towards the child (Mash & Barkley, 2014; Mynard & Joseph, 2000).

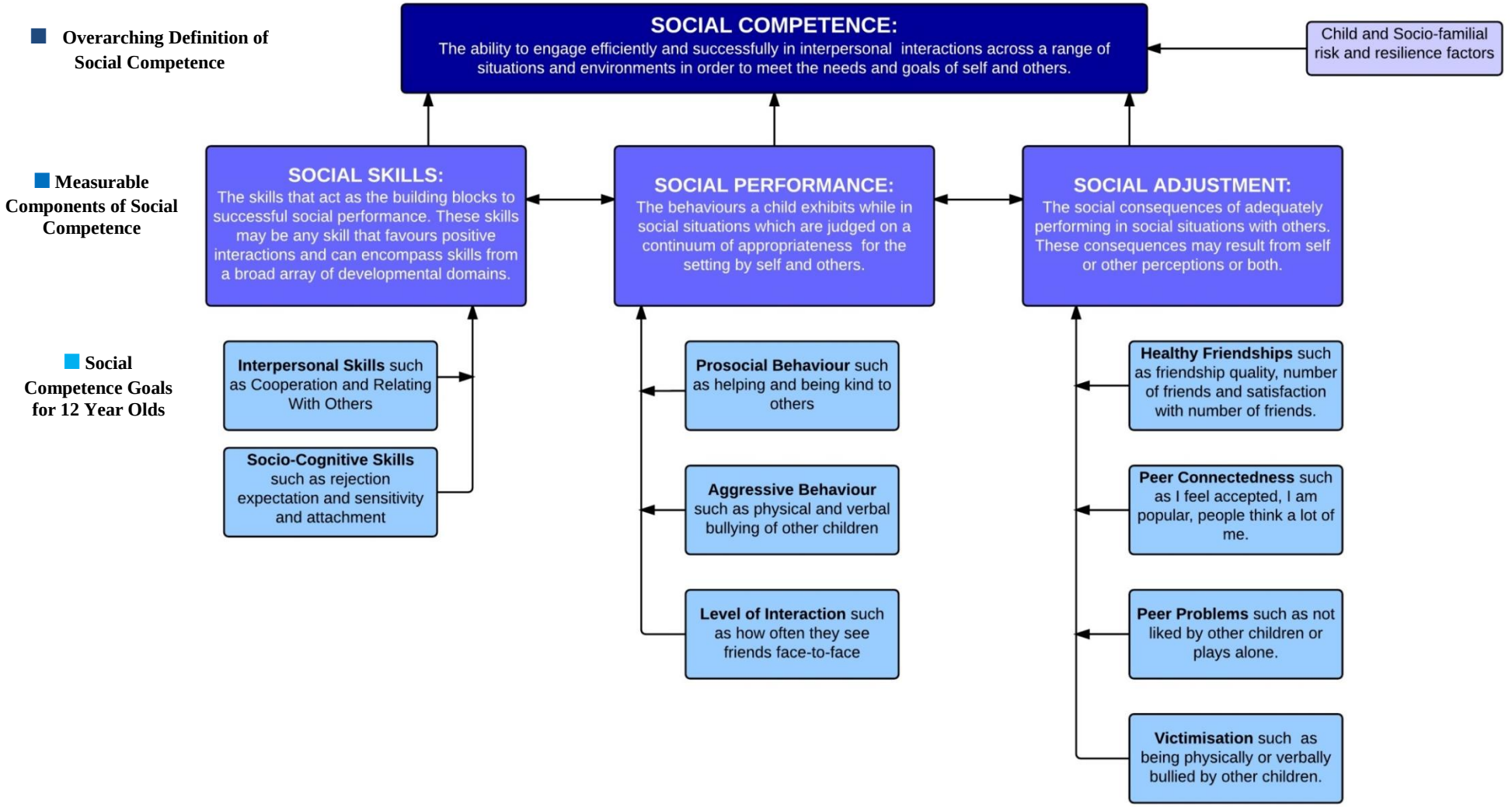

Figure 2.1: Social Competence Model Employed in This Thesis

2.3 The Tri-Component Model of Social Competence

Social competence is a comprehensive multi-dimensional construct which is made up of many skills and behaviours (Arnold & Linder-Muller, 2012; Lemerise & Arsenio, 2000; Raino, 2008; Semrud-Clikeman, 2007; Stump et al., 2009; Waters & Sroufe, 1983). These include interactions with others, specific behavioural responses, conflict resolution, relationship durability and quality, social popularity or acceptance and the possession and use of social skills (Raino, 2008; Rose-Krasnor, 1997; Semrud-Clikeman, 2007; Stump et al., 2009). The skills which influence the development of social competence are endless and include social, emotional, cognitive, executive functioning and motivational skills (Carr, 2006; Hops & Finch, 1985; Raino, 2008; Rose-Krasnor, 1997; Semrud-Clikeman, 2007). Given the diversity and complexity of social competence, another challenge for theorists in the field has been to develop a model of social competence which is flexible yet comprehensive enough to allow social competence to be ably addressed in a research context. A simple yet comprehensive model of social competence is the tri-component model proposed by Cavell (1990). This model asserts that three components, hierarchically linked, constitute social competence: *Social adjustment; social performance; and social skills* (see Figure 2.1). The model views a child's competence at each level as depending in part on their functioning at lower levels of the hierarchy.

2.3.1 Social adjustment. Social adjustment at the top of the hierarchy, relates to a child's functional ability to achieve important social development goals (Cavell, 1990). The list of social adjustment goals a person can achieve for continuously having successful interactions with others could be endless (such as academic achievement, increased health, increased quality of life, increased income and so on). However, for the purposes of simplicity and focus for this thesis, only socially related goals (such as the formation of close friendships, or experiencing few peer problems) have been included in the examination of social adjustment.

2.3.2 Social performance. The next skill down in the hierarchy, social performance, is a component which refers to the ability to engage in appropriate interpersonal behaviour within interactions (Cavell, 1990). An example is helping and being kind to peers. Generally successful social performances occur when all involved in the interaction feel satisfied. Therefore, the adequacy of an individual's performed behaviour within these social tasks (such as prosocial behaviour) can be judged and reported by the self or others (Cavell, 1990). This increases the broadness and flexibility of the measurement of the model at this level (Raver & Zigler, 1997). Therefore, it is important that this component is measured by multiple informants and measures observable behaviours. Cavell (1990) also hypothesizes that successful social performance

influences the attainment of social adjustment outcomes. For example, prosocial behaviour influences the attainment of quality friendships (Markiewicz, Doyle, & Brendgen, 2001).

2.3.3 Social skills. The final component, at the lowest level of the hierarchy is social skills, which forms a foundation for effective social competence. Social skills in this thesis are viewed as continuous from being not competent through to average and competent. Cavell (1990) posits that a range of skills are important in the development of social competence. The level of an individual's social skills influences the behaviour and outcomes measured in the higher components of this model (Cavell, 1990). For example, the skill of co-operation influences the chances that an individual will have successful interactions with others (social performance). This component is different from the social performance component as the possession of skills is captured in the social skills component and using these skills to engage in positive social interactions is captured by the social performance component (Cavell, 1990).

Figure 2.1 displays this model and the relationships of the components to each other. Recent evidence suggests that the three components are not only linked in an ascending order with lower levels impacting higher components, but experience in higher components also increases an individual's ability in lower levels (Lansford, Malone, Dodge, Pettit, & Bates, 2010). For example, a child who maintains quality friendships has more opportunity to engage and practice successful social performance, which would encourage the enhancement of social skills. Importantly, the tri-component model also addresses internal and external risk and resilience factors that can influence child development such as socio-economic status (SES), temperament, parenting, intelligence, and appearance (Cavell, 1990).

The tri-component model has been adopted in this thesis because it is comprehensive and it has been successfully employed in previous studies of social development in high-risk children, providing these studies with a robust, high quality framework (Devine, Holmbeck, Gayes, & Purnell, 2012; Nassau & Drotar, 1997; Rantanen, Eriksson, & Nieminen, 2012). Additionally, this model can be utilized for a research and an intervention framework, meaning it has clinical utility (Cavell, 1990). Within this thesis, this model provided a framework:

1) For defining and conceptualising social competence;
2) To guide the measurement and assessment of social competence;
3) To help organise and synthesise the pre-existing literature;
4) And to structure the results sections of this thesis.

Below is a detailed example of social competence at age 12 years based on the tri-component model. The model has been tailored to be developmentally appropriate for pre-adolescents based on recent advances in the theoretical knowledge of social development.

2.4 Social Competence of Pre-adolescents at Age 12 Years

Social competence is made up of three components in a hierarchical structure: *Social adjustment; social performance, and social skills*. This section provides a description of the expected developmental goals of a pre-adolescent within each component (see Figure 2.1).

2.4.1 Social adjustment. This component captures the overall goals of social development that a child may achieve from continuous successful social performances. Examples include having quality friendships, a feeling of connectedness with peers and low levels of peer problems (Cavell, 1990; Stump et al., 2009). Within this component, based on theory and the recent literature of the social developmental goals of pre-adolescents, five domains have been chosen to represent a child's social adjustment: *number of friendships and satisfaction with number of friends; friendship quality; peer connectedness; peer problems; and victimization from others.*

As can be seen, friend and peer relationships are a focus of pre-adolescents social adjustment goals. This is because at age 12 years, pre-adolescents are moving from middle-childhood and preparing themselves for high-school and adolescence where peer relationships become one of the most complex yet important aspects of their daily functioning (Kouros et al., 2010). Thus, at this stage of life, peer functioning (as a result of successful interactions with peers) is a key social developmental goal (Englund, Levy, Hyson, & Sroufe, 2000; Hartup & Stevens, 1999). Each social adjustment goal that has been included follows with justification for its inclusion.

Number of friendships and satisfaction with number of friends. The first important goal for children of almost any age is their ability to establish and maintain friends which increases in importance in pre-adolescence and adolescence. Not having any friends puts a child at risk of victimization and can indicate a lack of social skills (Asher & Renshaw, 1981; Rigby, 2008). However, as some children are satisfied with only having one (or even no) friends it is also important to take into account whether the individual feels satisfied with the number of friends they have (Parker & Asher, 1993a). Friendship satisfaction has been shown to be a protective factor against developing negative internal working model of others and influences how one perceives and performs in social interactions (McLachlan, Zimmer-Gembeck, & McGregor, 2010).

Friendship quality. Secondly, during preadolescence, children are moving from playing co-operatively with others, sharing toys, learning to tolerate rules and how to maintain friendships, to a more complex level of friendships. More specifically, the friendships of a pre-adolescent are theorised to increase in quality such as having less conflict and more intimacy and companionship (Hartup & Stevens, 1999). Quality friendships have been shown to increase an individual's wellbeing particularly during adolescence (Hartup & Stevens, 1999). For example, having a close friend has been shown to influence mental health, self-esteem, and increased ability to cope with

stressors (Berndt, 2002; Hartup & Stevens, 1999; Myers & Diener, 1995). Alternatively, low quality friendships have been found to lead to children liking school less, lower engagement in activities, and an increase in loneliness and disruptive behaviours (Berndt, 2002; Hartup & Stevens, 1999). Rose-Krasnor (1997) stated that friendship success can be measured by friendship quality. Therefore, number of friends, satisfaction with number of friends and friendship quality were chosen as developmentally appropriate social adjustment goals. However, harmonious relationships are also expected with their wider peer group at school.

Peer relationships and victimisation. A methodologically sound way to measure ones social success is to measure the extent to which one is positively received in a social context (Stump et al., 2009). For example, if a child has poor social interactions with others or lacks social skills they are at increased risk of experiencing peer problems and/or bullying from peers (Boulton, 1999; Hanish & Guerra, 2004; Rubin, Coplan, & Bowker, 2009). Socially competent preadolescents feel connected to and accepted by their peers (Geldard & Geldard, 2008; Hartup & Stevens, 1999; Rudolph, Hammen, & Burge, 1995) and experience low levels of difficulty with peers characterised by getting along with others, not being victimised and engaging with others of similar ages (Boulton & Smith, 1994; Ladd, 2005; Rigby, 2008; Rubin et al., 2009; Stump et al., 2009). Those that do not feel connected with peers or are victimised by their peers are at increased risk of poorer wellbeing (such as less positive affect, less life satisfaction) and later emotional problems (Jose, Ryan, & Pryor, 2012; Wolke, Baumann, Strauss, Johnson, & Marlow, 2015). In other words, their interactions with peers should be stable and positive without much difficulty. Therefore, the level of peer connectedness as reported by the child, peer problems as reported by parents and teachers, and victimisation a child experienced was also included in the conceptualisation of social competence.

2.4.2 Social performance. Social performance is the next component down in the hierarchy and is defined as the behaviours a child exhibits while in social situations. The component of social performance was divided into three areas in a previous study which also used the tri-component model for the measurement of social competence in a high-risk sample of children (Yeates et al., 2007). These three areas were: *prosocial behaviour (helping others); aggressive behaviour (bullying others); and withdrawn behaviour (level of interaction*; Cavell, 1990; Denham et al., 2003; Phillipsen, Bridges, McLemore, & Saponaro, 1999; Yeates et al., 2007).

Prosocial behaviour, aggressive behaviour and level of interaction. Yeates et al. (2007) included these goals to address the three movements that occur in human interactions: moving with each other (prosocial); moving against each other (aggressive); and moving away from each other (withdrawn). During preadolescence, 12 year olds should begin to increase their time spent engaging socially with same-age peers as opposed to infrequently or never (Rawlins, 1992).

Research has identified that children with less prosocial behaviour, more argumentative behaviour and shy/withdrawn behaviour tend to have lower levels of peer acceptance and higher levels of peer rejection/peer problems (both social adjustment goals described above) than children who can interact and relate with their peers well (Boulton, 1999; Dodge, McClaskey, & Feldman, 1985; Phillipsen et al., 1999). Therefore, these three areas were also incorporated into the current model in order to provide strength and structure to the social performance component.

2.4.3 Social skills. As per Cavell's model (1990) the social skills component is perceived to be the foundation of the hierarchy. However, he does not delineate the various skills that may be included to ensure comprehensive measurement. Unlike Cavell's model (1990), this thesis explicitly specifies the target skill areas which, as shown in literature, contribute to children's social development. Within the literature, six skill sets have been identified that have been shown in the literature to impact social competence: Cognitive; emotional; behavioural; communicative; interpersonal; and social-cognitive (Calkins, Gill, & Williford, 1999; Dodge & Coie, 1987; Engels, Finkenauer, Meeus, & Deković, 2001; Geldard & Geldard, 2008; Rubin & Rose-Krasnor, 1992; Semrud-Clikeman, 2007). The skills sets such a language skills and cognitive skills already have their own set of literature assessing VPT born children's abilities in those areas and show VPT born children to be at risk compared to FT born children (Aarnoudse-Moens, Weisglas-Kuperus, et al., 2009; Barre et al., 2011; Bhutta et al., 2002; Clark, Woodward, Horwood, & Moor, 2008a; Hayes & Sharif, 2009; Mulder et al., 2009). Therefore, for the purposes of this thesis, only the most socially related skills, *interpersonal skills* and *socio-cognitive skills* are measured.

Interpersonal social skills. Interpersonal skills have been identified as a key part of aiding social performances and social adjustment with peers (Cavell, 1990; Phillipsen, et al., 1999). These skills are essential to the development of social competence. For example, for interactions to occur smoothly with peers in early and middle childhood, a child must learn to share, play co-operatively, take turns, and be able to interact with more than one child at a time by tuning into the group, and knowing how to join in (Carr, 2006; Geldard & Geldard, 2008; Ladd, 1990; Rubin & Rose-Krasnor, 1992). Children with these skills have been shown to have more peer acceptance (Hatzichristou & Hopf, 1996; Ladd, Price, & Hart, 1988). Furthermore, children who are warm, funny and are more relatable tend to be more popular with their peers (Carr, 2006).

Each of these abilities requires a number of specific skills which develop with age. As pre-adolescents become less egocentric they develop the skills to be able to: understand what others want and need; problem solve; and regulate their behaviours and emotions (Carr, 1990). This in turn enables social interactions with friends and peers to occur smoothly (Carr, 2006). Thus at age 12 years, it is anticipated that group-work skills, cooperation skills and skills in relating to others

should be developed and retained from lower developmental ages and would be necessary in achieving their social development goals during pre-adolescence (D'Zurilla & Goldfried, 1971; Dodge & Coie, 1987; Ladd, 2005; Rubin & Rose-Krasnor, 1992; Waters & Sroufe, 1983).

Socio-cognitive skills: The socio-cognitive skills included for measurement in this thesis, are parent and friend attachment and rejection sensitivity. Children develop general beliefs about the self and others based on their experiences with others (Bowlby, 1973; Carr, 2006; Crick & Dodge, 1994; Ladd, 2005; Sperling & Berman, 1994). These beliefs, even if developed in a family context, have been shown to be activated and utilised in social situations which can then positively or negatively influence ones interactions with peers (Carr, 2006; Rudolph, Hammen & Burge, 1995). A secure attachment with parents and peers has also been found to lead to higher self-esteem and life satisfaction (Armsden & Greenberg, 1987) and has been recommended to be included in the assessment of social competence (Raino, 2008; Rose-Krasnor, 1997).

Cognitive processes and/or underlying skills also influence the nature of behaviour (Beck, 2011). In a social setting the underlying skills, cognitive biases and expectations of others' responses in a social situation affects how one behaves in a social interaction For example, children with beliefs that they will be rejected by others may behave more aggressively with peers (poor social performance), which can lead to conflict, less friends and a feeling of isolation from peers (poor social adjustment; Crick & Dodge, 1994; Lansford et al., 2010). Conversely, low levels of rejection sensitivity would in turn facilitate stable and positive behavioural interactions. Therefore, it is expected that a socially competent 12 year old should have positive beliefs of others as being consistently trustworthy, to respond reliably and to not reject them (Carr, 2006; Rudolph, Hammen & Burge, 1995).

2.4.4 Factors associated with social competence. As well as being influenced by these lower components of social skills and social performance, social adjustment can also be affected by a wide range of developmental factors. An individual's internal characteristics (such as gender, ethnicity, genes, temperament and level of intelligence) and external influences (such as parenting, parental mental health, inter-parental conflict, parental support, opportunity, SES and school environment) are important mechanisms in shaping the development of a child's social competence (Berndt, 2002; Bronfenbrenner & Morris, 1998; Campbell, Lamb, & Hwang, 2000; Carr, 2006; Cavell, 1990; Engels et al., 2001; Hartup & Stevens, 1999; Lemerise & Arsenio, 2000; Orpinas & Horne, 2006; Phillipsen et al., 1999; Pope & Ward, 1997; Raino, 2008; Rose-Krasnor, 1997; Semrud-Clikeman, 2007; Stump et al., 2009).

Furthermore, researchers investigating other at-risk samples have highlighted the importance of incorporating neonatal and medical risk factors as important determinants on a

child's social development (Yeates et al., 2004). As these developmental mechanisms are widely known to influence social development, it is important to include and investigate the impact of neonatal, child and environmental risk and resilience factors when investigating the developmental pathway of social competence in at-risk children. Important associated child and family characteristics included in this thesis are: sex; SES; minority ethnicity; maternal age at child birth; child motor ability; visual difficulty; hearing difficulty; severity of cerebral palsy; hyperactivity; emotional problems; academic achievement; intelligence; body mass index; pubertal development; and team sport participation (Bejerot & Humble, 2013; Bejerot, Plenty, Humble, & Humble, 2013; Carr, 2006; Cavell, 1990; Rose-Krasnor, 1997; Wolke, Baumann, Strauss, Johnson, & Marlow, 2015).

2.5 Conclusion

This chapter provided an overview of the current state of social competence in the literature. Although a disorganized and complicated field, this chapter aimed to describe social competence from a developmental perspective. A flexible and comprehensive framework was presented which is used throughout this thesis to ground and streamline the research. This conceptualisation views social competence as comprised of three components namely: social adjustment which measures overarching social goals; social performance, which addresses social behaviour within interactions; and social skills which are the underlying skills necessary for effective social interactions to occur. A description of the expected developmental goals of a 12 year old was also outlined within each component in order to highlight the developmentally appropriate areas targeted in this thesis. Given the difficulties in this field of research, in combination with the paucity of research conducted on the social competence of EPT/VPT born children there is a clear need for a systematic review. No reviews to the best of the author's knowledge currently exist on this topic. Therefore, the next chapter characterises the pre-existing research and outlines what is and is not known about the development of social competence in EPT and VPT born children across childhood and adolescence.

"Kids in class look out for him but he has no real friends."

-Parent of EPT born male participant (born at 27 weeks)

Chapter Three

Social Development of Children Born Very Preterm: A Systematic Review[1]

Currently, a small but growing body of studies suggests that children born EPT/VPT are subject to a range of social and behavioural difficulties that may affect their life-course opportunities (Bora et al., 2011; Farooqi, Hagglof, Sedin, Gothefors, & Serenius, 2007; Samara, Marlow, Wolke, & Group, 2008). Several contemporary follow-up studies have also found an increased risk of autism spectrum disorders and related behaviours in survivors of EPT/VPT birth (Johnson et al., 2010a; Limperopoulos, 2009; Meldrum et al., 2013). Although suggestive of a possible link between prematurity and later social problems, the interpretation of existing research has been limited by several methodological problems. First, there is considerable variability across studies in the outcomes assessed. Second, few studies have drawn on existing developmental research in the identification of a clearly defined set of social competence constructs that are important for children's longer-term adaptive functioning. Most studies have narrowly focused on a single aspect of social functioning or a small subset of behaviours and/or competencies. Finally, so far, there have been no systematic reviews or meta-analyses of the social development of children born VPT, making it difficult to understand the nature of their social strengths and difficulties, the development of social competence over time, and the processes that may place children born VPT at risk of social competence difficulties.

Therefore, using the tri-component model as a conceptual framework, the aim of this chapter was to review systematically empirical studies of social competence in children born VPT to address the following issues. (1) To describe the social functioning of children born VPT across the three components of social competence alongside the methodologies used. (2) To examine the

[1] Adapted from "Social Competence in Children Born Very Preterm," by Ritchie, Bora and Woodward, 2015, *Developmental Medicine and Child Neurology*. Reproduced with permission from John Wiley & Sons.

extent to which social competence of children born VPT varies over the course of child development. (3) To identify neonatal and social factors associated with an increased risk of social competence problems for children born VPT.

3.1 Method

3.1.1 Data source. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Liberati et al., 2009) guideline was used for this systematic review. A search of the PubMed and PsycINFO electronic databases for original articles was undertaken for the period from January 1991 to March 2014. US National Library of Medicine Medical Subject Headings (MeSH) terms and/or keywords included preterm birth; low birthweight; premature; social; competence; peer; friendships; social interaction; psychosocial; relationships; and behaviour. Google Scholar and hand-searching of pertinent bibliographies identified additional articles.

3.1.2 Study selection. Two independent reviewers (KR and SB) undertook independent electronic database searches, followed by a research assistant replicating the search to ensure accuracy. Relevant articles were initially screened by title and abstract, and were included if they met six criteria: (1) peer-reviewed English language publication; (2) sample included children born VPT (gestation ≤33wk and/or birthweight ≤1500g) and a comparison group of term-born children; (3) children were born after 1990; (4) children aged 0 to 17 years; (5) at least one aspect of the tri-component model was evaluated and specifically mentioned in the aims or hypotheses (using any social term); and (6) social competence was assessed using standardized screening measures, clinical diagnostic tools, and/or observational methods. Exclusion criteria included the following: (1) exclusive focus on mental health outcomes, psychiatric disorders, internalizing/externalizing problems, or closely related but independent constructs such as emotion regulation, attachment, and temperament when assessed without a social development focus; (2) assessed skills that could influence social competence but did not conduct this research with a social competence focus (for example, articles purely focusing on emotional regulation without a social competence connection); this was due to practical constraints, as well as to ensure a focus on social competence was maintained in this review; (3) the measurement of social competence was confounded within wider constructs such as adaptive functioning; (4) sample included high-risk or medically selected children born VPT only; and (5) gestational age data not reported. In three instances, two articles based on the same cohort and follow-up age were suitable for review (Clark et al., 2008a; Hack et al., 2005; Jones, Champion, & Woodward, 2013; Taylor,

Klein, Drotar, Schluchter, & Hack, 2006; Woodward et al., 2009). The article examining the most relevant outcomes was included (Jones et al., 2013; Taylor et al., 2006).

3.1.3 Data extraction. All articles meeting the selection criteria were further assessed by a single reviewer (KR) who extracted relevant data, including sample selection criteria, year and country of birth, gestational age, birthweight, sample size, assessment age, construct(s) assessed, assessment measure(s) used, recruitment source, study design, retention/response rate, exclusion criteria, comparison group selection, proportion of children classified as socially impaired, odds ratio with confidence intervals, between-groups mean difference and standard deviation. Quality assessment of all articles was undertaken using an adapted rating scale (Bhutta et al., 2002; see Table A.1 in Appendix A). Studies scoring at least 8 out of 10 were classified as being high quality, and were given greater weight in the interpretation of results. Uncertainties were discussed and resolved with other authors. Data extraction and quality assessment were then replicated by a second reviewer to ensure accuracy. While the preliminary plan was to report results in terms of combined standardized mean difference and/or odds ratio, results from studies were critically reviewed, synthesized, and finally interpreted qualitatively because of considerable heterogeneity in outcome measures. If a paper referred to an intention to study social competence (or some variation of the term) within the aim or hypotheses, and used a measure that assessed social competence, it was included as a primary study of social competence. If an included study stated within the aim it wanted to assess a wider domain of outcomes, for example 'behavioural and emotional development', and within that measured (typically less comprehensively) an aspect of social competence, it was included in the second group of studies that did not specifically set out to study social competence.

3.2 Results

Figure 3.1 summarizes the study inclusion and exclusion procedures. As shown, the initial search yielded 6458 articles. After reviewing titles and abstracts, 115 articles were identified and retrieved for further evaluation. Of these, 23 met selection criteria. Seven articles were concerned exclusively with social competence and greater weight was given to their results (De Schuymer, De Groote, Striano, Stahl, & Roeyers, 2011; Farooqi et al., 2007; Hoff, Hansen, Munck, & Mortensen, 2004; Jones et al., 2013; Scott et al., 2012; Spittle et al., 2009a; Yau et al., 2013). The remaining 16 articles assessed social competence as one of a range of child developmental outcomes using mostly parent and/or teacher report questionnaires (Anderson et al., 2003; Baron, Erickson, Ahronovich, Baker, & Litman, 2011; Bayless, Pit-ten Cate, & Stevenson, 2008; Bora et al., 2011; Charkaluk et al., 2010; Delobel-Ayoub, Arnaud, White-Koning, Casper, Pierrat, Garel, Burguet,

Roze, Matis, Picaud, Kaminski, Larroque, et al., 2009; Delobel-Ayoub, Kaminski, Marret, Burguet, Marchand, N'Guyen, Matis, Thiriez, Fresson, Arnaud, Poher, Larroque, & Group, 2006; Elgen et al., 2012; Hutchinson et al., 2013; Larroque et al., 2011; Reijneveld et al., 2006a; Samara, Marlow, Wolke, et al., 2008; Taylor et al., 2006; Theunissen et al., 2001; Treyvaud, Doyle, et al., 2012; Vederhus, Markestad, Eide, Graue, & Halvorsen, 2010a). Results from these studies were used to support, or not, findings from the primary set of social competence studies. Therefore, across all tables, studies were divided into two groups: those with a major focus on social competence and those assessing social competence as one of a range of outcomes. Within these groups, studies were further ordered according to child's chronological age at the time of assessment.

3.2.1 Characteristics of studies. Table 3.1 describes the methodological characteristics of the studies reviewed. As shown, 18 of 23 studies provided specific gestational information for children born VPT with an average reported gestational age of 27.6 weeks (SD 1.8) and birthweight of 1030.6g (SD 238.4). Sample sizes varied from 57 to 6409 children and involved a total of 17,119 children ranging in age from 3 months to 14 years. Of these, 12 were infancy and early childhood studies (0–5 years), seven middle childhood (6–9 years), three pre-adolescence (10–12 years), and one adolescent study (13–17 years). Three studies included children of different ages (Bayless et al., 2008; De Schuymer et al., 2011; Theunissen et al., 2001).

Of the seven primary social competence studies, the samples of four included only children born extremely preterm (EPT) (gestation <28wk; Farooqi et al., 2007; Hoff et al., 2004; Scott et al., 2012; Yau et al., 2013) and three included children born VPT (De Schuymer et al., 2011; Jones et al., 2013; Spittle et al., 2009a). Two studies included geographical cohorts from Denmark (Hoff et al., 2004) and Sweden (Farooqi et al., 2007), three were regional cohorts from New Zealand (Jones et al., 2013) and the USA (Scott et al., 2012; Yau et al., 2013), and another two were single-centre cohort study from Australia (Spittle et al., 2009a)and the Netherlands (De Schuymer et al., 2011). Six were prospective longitudinal studies (75–100% retention) and the Danish study was a cross-sectional design (91% response). When all studies were combined, 10 out of 23 studies included only children born EPT and the rest included children born both EPT and VPT. Most studies (17/23) were based on geographical or regional cohorts. Although 19 out of 23 studies had a prospective longitudinal research design, only eight achieved retention rates higher than 85%. Response rates of two of four cross-sectional studies were less than 34%. Only two out of the seven studies focused on social competence were of high methodological quality. Of those studies with a more general focus, only 3 of 16 were considered to have high-quality methodology.

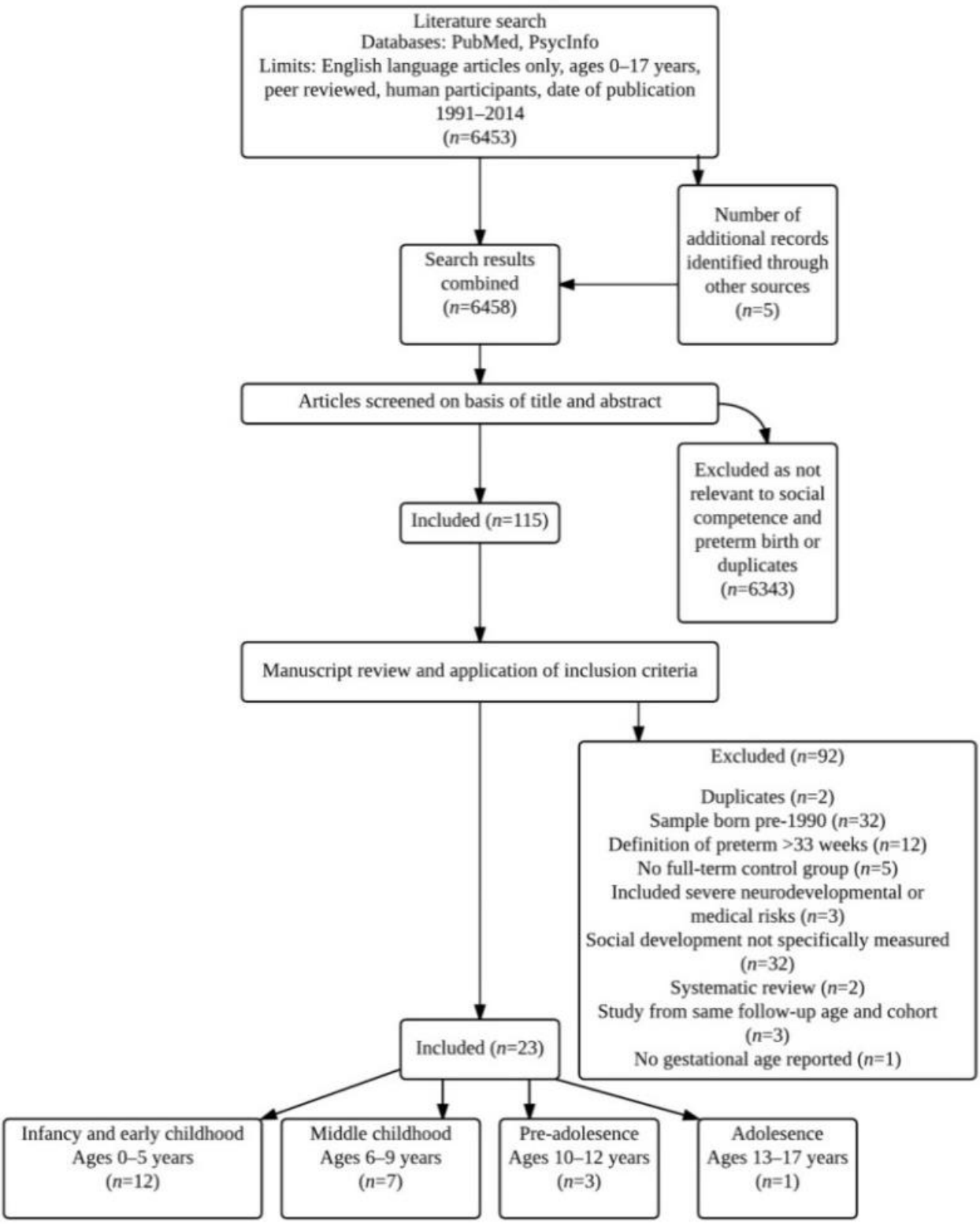

Figure 3.1: Flow Diagram of Study Selection Process for Systematic Review.

Table 3.1: Methodological Characteristics of the Studies of Social Competence in Children Born VPT Included in the Systematic Review

Reference	Sample characteristic					Methodology				Study quality rating (score)
	Country; birth year	VPT group gestation (wk) birthweight (g)		Sample size	Age at follow-up (y)	Recruitment source and study design	Retention/ response rate of VPT group (%)	VPT group exclusion criteria	Term-born group inclusion criteria	
		Inclusion criteria	Final sample, mean (SD)							
Studies with a primary social competence focus										
De Schuymer et al., 2011	Belgium; NR	≤32 NA	29.3 (1.9), 1279.2 (413.5)	VPT: 26 FT: 31	3, 6, 9mo	Single centre Case–control Longitudinal	100	Sensory difficulties, meningitis, encephalitis, congenital abnormalities, syphilis, short bowel syndrome, mother <18y, used drugs, or non-Dutch speaking.	Randomly recruited from two primary health services	Low (4)
Spittle et al., 2009	Australia; 2001–2004	<30 or <1250	27.4 (1.9), 964.0 (223.0)	VPT: 188 FT: 70	2	Single centre Case–control Longitudinal	83	Congenital abnormalities	Controls at lower social risk recruited at term age and maternal child health centres within Melbourne at age 2y	Low (5)
Jones et al., 2013	New Zealand; 1998–2000	≤33 NA	27.8 (2.4), 1058.1 (312.8)	VPT: 103 FT: 105	4	Single centre Regional Case–control Longitudinal	98	Non-English-speaking parents, Congenital abnormalities, blindness, incomplete data	Hospital records, individually matched on sex and birth date	High (8)
Hoff et al., 2004	Denmark; 1994–1995	<28 or <1000	27.5 (1.8), 924.6 (168.7)	EPT: 194 FT: 72	5	Geographical Case–control Cross-sectional	91	Non-native Danish-speaking parents, missing information (majority with disabilities)	Able-bodied children matched on age, sex, parental education and residence	Low (5)
Scott et al., 2012	USA; 2001–2003	<28 or <1000	26.0 (2.0), 818.0 (174.0)	EPT: 148 NBW: 111	6	Single centre Regional Case–control Longitudinal	75	Attending home or special education full time, congenital abnormalities, infections, lived in distant area, no control match	Classmates, individually matched as close as possible for age, sex, and ethnicity after parents had given permission	Low (6)
Farooqi et al., 2007	Sweden; 1990–1992	<26 NA	24.6 (0.7), 765.0 (111.0)	EPT: 86 NBW: 86	11	Geographical Case–control Longitudinal	97	None reported	Recruited from the national birth register at age 11y, matched for hospital, sex, birth date	High (9)
Yau et al., 2013	USA; 1992–1995	NA <1000g	26.0 (2.0), 816.0 (123.0)	ELBW: 172 NBW: 115	14	Single centre Regional Case–control Longitudinal	76	Malformations, AIDS, tuberous sclerosis	Randomly selected at age 8y from the same school, matched for age, race, and sex	Low (7)

Table 3.1 continued

Studies examining social competence within a global behaviour adjustment framework

Theunissen et al., 2001	Netherlands; 1996	<32 NA	<32, <2500	VPT: 65 RG: 50	1–4	Single centre Case–control Longitudinal	86	No gestational information	Random sample from well-baby clinics across country	Low (4)
Charkaluk et al., 2010	France; 1997	22–32 NR	30.1 (2.0), 1390.0 (403.0)	VPT: 347 FT: 57	2	Multi-centre Geographical Case–control Longitudinal	69	Disabilities such as deafness, blindness, or severe cerebral palsy; multiple births; >4y	Unmatched term controls recruited at hospital discharge	Low (5)
Delobel-Ayoub et al., 2006	France; 1997	22–32 NA	≤32, NR	VPT: 1228 FT: 447	3	Multi-centre Geographical Case–control Longitudinal	79	Disabilities such as deafness, blindness, or severe cerebral palsy; multiple births; >4y	Unmatched term born controls recruited at hospital discharge	Low (5)
Baron et al., 2011	USA; 2004–2006	≤33 and <1000	26.0 (1.7), 782.6 (149.3)	VPT: 60 FT: 90	3	Single centre Case–control Cross-sectional	33	Incomplete testing (due to non-compliance and disability)	Mailing of letters to randomly selected eligible children born at the hospital, flyers, parent groups	Low (2)
Treyvaud et al., 2012	Australia; 2001–2003	<30 or <1250	27.3 (2.0), 965.0 (221.0)	VPT: 170 FT: 64	5	Single centre Case–control Longitudinal	75	Neurosensory impairment, distant location	Recruited at birth from hospital maternity wards or at 2y from maternal health centres in Melbourne	Low (5)
Elgen et al., 2012	Norway; 1999–2000	<28 or <1000	22–27, 851.0 (170.0)	EPT: 255 RG: 1089	5	Geographical Case–control Longitudinal	69	Down syndrome, some parents not completing owing to child disability (not all excluded)	All families attending routine public health check-up at age 5–6y were invited to participate	Low (6)
Delobel-Ayoub et al., 2009	France; 1997	22–32 NA	≤ 32, NR	VPT: 1102 FT: 375	5	Multi-centre Geographical Case–control Longitudinal	75	Disabilities such as deafness, blindness, or severe cerebral palsy; multiple births; >6y	Unmatched term born controls recruited at hospital discharge	Low (5)
Reijneveld et al., 2006	Netherlands; 1992–1995	<32 or <1500	30.2 (1.9), 1268.0 (329.0)	VPT: 402 RG: 6007	5	Multi-centre Geographical Case–control Cross-sectional	76	None reported	Five-year-old child data obtained from families involved in other articles within the routine public health check-up programme	Low (2)
Samara et al., 2008	UK and Ireland; 1995	≤25 NA	≤25, NR	EPT: 200 RG: 148	6	Multi-centre Geographical Case–control Longitudinal	65	None reported	Classmates individually matched for age and sex	High (8)

Table 3.1 continued

Bora et al., 2011	New Zealand; 1998–2000	≤33 NA	27.8 (2.4), 1063.7 (317.4)	VPT: 104 FT: 108	6	Single centre Regional Case–control Longitudinal	97	Non-English speaking parents, congenital abnormalities, foetal alcohol syndrome, incomplete data	Hospital records, individually matched on sex and birth date	Low (7)
Larroque et al., 2011	France; 1997	22–32 NA	<32, NR	VPT: 1444 FT: 327	8	Geographical Case–control Longitudinal	64	Severe motor or sensory deficiencies at age 5y	One of every four births in the maternity or neonatal units of the regions	Low (5)
Anderson et al., 2003	Australia; 1991–1992	<28 or <1000	26.7 (1.9), 884.0 (162.0)	EPT: 275 FT: 223	8	Multi-centre Regional Case–control Longitudinal	92	Neurosensory impairments, missing data	Randomly selected at birth from level III perinatal centres in the region, matched for sex, mother's birth country, health insurance status	High (8)
Hutchinson et al., 2013	Australia; 1997	<28 or <1000	26.5 (2.0), 833.0 (164.0)	EPT: 189 FT: 173	8	Multi-centre Regional Case–control Longitudinal	94	Children not admitted to neonatal intensive care unit	Randomly selected, matched for expected age, sex, mother's birth country, health insurance status	High (8)
Taylor et al., 2006	USA; 1992–1995	NR <1000	26.4 (2.0), 810.0 (124.0)	ELBW: 204 FT: 176	8	Single centre Case–control Longitudinal	66	Congenital malformations or infections	Randomly selected at school age of children at the same school, matched for age, race, and sex	Low (6)
Bayless et al., 2008	UK; NR	<32 NA	28.8 (2.1), 1241.0 (361.9)	VPT: 69 RG: 70	6–12	Single centre Regional Case–control Cross-sectional	30	Inappropriate birthweight to gestational age, multiple births, severe disability	Children with no developmental disabilities from local primary schools, not matched	Low (3)
Vederhus et al., 2010	Norway; 1991–1992	<28 or <1000	26.7 (1.7), 93.3 (204.0)	EPT: 35 FT: 31	10	Single centre Regional Case–control Longitudinal	100	NR	Selected the closest temporally born child of same sex, and weighed between 3 and 4kg at birth	Low (5)

Note: VPT: very preterm (gestation <33wk); SD: standard deviation; NR: not reported; NA: not applicable; FT: term-born (gestation between 38–42wk); EPT: extremely preterm (gestation <28wk); NBW: normal birthweight; ELBW: extremely low birthweight (<1000g); RG: reference group.

Table 3.2: Scope and Assessment of Social Competence in Children Born VPT Across Studies Included in the Systematic Review

Reference	Scope of social competence		Assessment of social competence			
	Definition	Aspects of tri-component model	Methodology	Measure	Outcome variable	Informant
Studies with a primary social competence focus						
De Schuymer et al., 2011	Aimed to assess dyadic and triadic social skills as these reflect social cognitive development in infants. In the first 6mo of life dyadic skills (between two people) develop and in the second 6mo of life triadic skills develop (interacting with another person and an object)	Social skills	Standardized observed task	Still face paradigm	Dyadic skills: smiling, vocalizing, motor re-engagement, gazing at experimenter Triadic skills: gaze at experimenter, gaze at target object, gaze at non-target object, gaze away, smiling	Blind rater
Spittle et al., 2009	None	Social performance Social skills	Rating scale	ITSEA	Social skills: compliance, attention, imitation/play, mastery motivation, empathy Prosocial behaviour	Parent
Jones et al., 2013	Development of skills and abilities essential for the formation of positive relationships with others including behavioural and emotional adjustment (internalizing and externalizing behaviour), emotional regulation (capacity to modulate emotions in a range of situations), a child's interactive behaviour with others (skills and abilities involved in forming and maintaining relationships with others which foster popularity and acceptance) and social cognitive processing (theory of mind).	Social adjustment Social performance Social skills	Rating scale, Standardized assessment task, Observation	PIPPS, SDQ, BRIEF-P, Adapted ERC and ITSC, Theory of mind tasks (Sally-Ann, Fishing Story, Smarties task)	Severe emotional and behavioural adjustment problems, emotional regulation, social interaction problems, social cognition	Parent Blind rater
Hoff et al., 2004	None	Social adjustment	Rating scale and questionnaire	SCBI	Social development	Parent
Scott et al., 2012	None	Social adjustment Social skills	Rating scale	SSBS-2	Peer relations Self-management/compliance	Teacher
Farooqi et al., 2007	None	Social adjustment Social performance	Rating scale	CBCL and TRF	CBCL Competence-social, CBCL Withdrawal, CBCL Social problems, TRF Withdrawal, TRF Social problems	Parent Teacher
Yau et al., 2013	None	Social adjustment	Rating scale	Social Acceptance and Bullying Scale of KIDSCREEN-52	Level of victimization	Self

Table 3.2 continued

Studies examining social competence within a global behaviour adjustment framework

Theunissen et al., 2001	None	Social adjustment	Rating scale	TAPQOL	Social functioning	Parent
Charkaluk et al., 2010	None	Social adjustment	Rating scale	Revised Brunet Lezine Scale	Sociability	Paediatrician
Delobel-Ayoub et al., 2006	None	Social adjustment Social performance	Rating scale	SDQ	Peer problems Prosocial behaviour	Parent
Baron et al., 2011	None	Social adjustment Social performance	Rating scale	BASC	Withdrawal Social skills	Parent
Treyvaud et al., 2012	None	Social adjustment Social performance	Rating scale	SDQ	Peer problems Prosocial behaviour	Parent
Elgen et al., 2012	None	Social adjustment Social performance	Rating scale	SDQ	Peer problems Prosocial behaviour	Parent
Delobel-Ayoub et al., 2009	None	Social adjustment Social performance	Rating scale	SDQ	Peer problems Prosocial behaviour	Parent
Reijneveld et al., 2006	None	Social adjustment	Rating scale	CBCL	Withdrawn, social problems	Parent
Samara et al., 2008	None	Social adjustment Social performance	Rating scale	SDQ	Peer problems Prosocial behaviour	Parent Teacher
Bora et al., 2011	None	Social adjustment Social performance	Rating scale	SDQ	Peer problems Prosocial behaviour	Parent Teacher
Larroque et al., 2011	None	Social adjustment Social performance	Rating scale	SDQ	Peer problems Prosocial behaviour	Parent
Anderson et al., 2003	None	Social adjustment Social performance	Rating scale	BASC	Leadership skills Social skills	Parent Teacher
Hutchinson et al., 2013	None	Social adjustment Social performance	Rating scale	SDQ	Peer problems Prosocial behaviour	Parent
Taylor et al., 2006	None	Social adjustment	Rating scale	VABS	Socialization	Parent
Bayless et al., 2008	None	Social adjustment Social performance	Rating scale	SDQ	Peer problems Prosocial behaviour	Parent
Vederhus et al., 2010	None	Social adjustment Social performance	Rating scale	Child Health Questionnaire – Parent Form.	Social functioning: physical, emotional/ behavioural Involvement in physical and social activities	Parent

Note: ITSEA: Infant–Toddler Social Emotional Assessment; PIPPS: Penn Interactive Peer Play Scale; SDQ: Strengths and Difficulties Questionnaire; BRIEF-P: Behaviour Rating Inventory of Executive Function-Preschool Version; ERC: Emotional Regulation Checklist; ITSC: Infant-Toddler Symptom Checklist; SCBI: Structured Child Behaviour Interview; SSBS-2: School Social Behaviour Scales, second edition; CBCL: Child Behaviour Checklist (Achenbach Scale); TRF: Teacher Rating Form (Achenbach Scale); TAPQOL: TNO-AZL Preschool Children Quality of Life Questionnaire; BASC: Behaviour Assessment System for Children; VABS: Vineland Adaptive Behaviour Scales.

3.2.2 Scope and assessment of social competence. Table 3.2 describes the study characteristics relating to each of the three components of social competence identified by the tri-component model. Also listed are the assessment measures. One of seven primary social competence studies presented a conceptual framework for measurement selection and operationally defined social competence (Jones et al., 2013). In contrast, all 16 general outcome studies assessed social competence using a global parent and/or teacher report measure, without an operational definition. Scale items were also rarely provided to clarify those aspects of social functioning being assessed. Of 23 studies, one assessed all three aspects of the tri-component model (Jones et al., 2013). A further 15 studies assessed two components (social adjustment and social performance: $n = 13$; social adjustment and social skills: $n = 1$; social performance and social skills: $n = 1$) and seven studies assessed one component (social adjustment: $n = 6$; social skills: $n = 1$).

Table 3.2 further shows that there was considerable variability in the measures used, with little overlap across studies. Only the New Zealand study used a multi-method approach, namely observational methods, tester administered tasks, and parent/teacher-rated behaviour scales (Jones et al., 2013). Another study used an observational method with blind raters but no additional ratings or informants (De Schuymer et al., 2011). The other four studies involved the use of self, parent, and/or teacher ratings to assess child social skills. Among the 16 general outcome studies, all used rating scales, with the Strengths and Difficulties Questionnaire (SDQ) being the most common (9/16). Although 5 out of 23 studies obtained information about child social competence from multiple informants, most (17/23) relied exclusively on a single informant, predominantly parents.

3.2.3 Development of social competence. Tables 3.3-3.5 describes the key findings of reviewed studies. Each table provides an overview of results for each component of social competence identified by the tri-component model. These include social adjustment (Table 3.3); social performance (Table 3.4); and social skills (Table 3.5). Table 3.6 further supplements these results by summarizing study findings with respect to the key social challenges affecting children born VPT over the course of development.

Social adjustment. As shown in Table 3.3, 21 out of 23 studies assessed social adjustment, the highest level of the tri-component model. This included quality of child's peer relations; peer problems; number of friends; social functioning; sociability; social interaction problems; victimization; withdrawn behaviour; leadership; and emotional and behavioural adjustment problems.

Of the five primary social competence studies that assessed social adjustment, two were based on samples from early childhood (Hoff et al., 2004; Jones et al., 2013), one from middle

childhood (Scott et al., 2012), one from pre-adolescence (Farooqi et al., 2007), and another from adolescence (Yau et al., 2013). All of these studies reported significant differences between term-born children and those born VPT on measures of social adjustment. At age 4 years, the New Zealand study found that children born VPT had a twofold increased risk of emotional problems (p = .008) and behavioural inattention/hyperactivity (p = .01; Jones et al., 2013). Similarly, the Danish study based on parent report at age 5 years showed children born EPT had higher rates of social maladjustment (e.g. more often plays with adults than peers, solitary play, hard to be away from home/dependent on parents, critical in contact with others, difficulty following rules and playing games, destroys playing situations) than their term-born peers (p = .02; Hoff et al., 2004). However, the results were confined to children with an IQ score less than 97.

In middle childhood, children born EPT had higher levels of teacher-rated defiant/disruptive (e.g. demanding and impulsive) behaviour (p = .007; Scott et al., 2012). They were also less interactive and more withdrawn than term-born children. These differences persisted after excluding children with neurosensory disabilities and low cognitive ability. No significant group differences were evident for hostile, irritable, antisocial, and/or aggressive behaviour.

In pre-adolescence, the Swedish study found that parents and teachers reported 11-year-old children born EPT as being more socially withdrawn than their term-born peers (p = .02; Farooqi et al., 2007). Parents also reported that their children born EPT had fewer friends and more peer relationship difficulties (p < .06). In line with the previous study from middle childhood, no significant between-groups differences were found for aggressive or delinquent behaviour.

In adolescence, based on self-ratings, 14-year-old males of ELBW were found to be victimized more often by school bullies than males of NBW (p = .009), but there were no significant group differences for females (p = .58; Yau et al., 2013). As shown in Table 3.3, social adjustment was also examined in all 16 of the general outcome studies, most commonly with the SDQ Peer Problems subscale (9/16). Consistent with the above studies, seven of these SDQ studies from early childhood through to pre-adolescence found children born EPT/VPT had significantly more peer relationship difficulties than term-born children compared with only two studies showing no group differences (Bayless et al., 2008; Larroque et al., 2011). Another two studies using social adjustment measures (TNO-AZL Preschool Children Quality of Life Questionnaire; Behaviour Assessment System for Children) also found no significant between-groups differences during early childhood (e.g. plays happily with other children, confident with other children, withdrawal; Baron et al., 2011; Theunissen et al., 2001).

Table 3.3: Social Adjustment Outcomes of Children Born VPT as Reported Across Studies Included in the Systematic Review

Reference	Results					Age at follow-up (y)	Confounders controlled for	Conclusion
	Mean difference	95% confidence interval	Odds ratio	95% confidence interval	*p*			
Studies with a primary social competence focus								
Jones et al., 2013	3.5	1.1 to 5.8	1.9	1.0 to 3.7	.02	4	SES, multiple births	Children born VPT displayed more emotional and behavioural problems than children born at term[a]
Hoff et al., 2004	NR	NC	NR	NR	.02	5	IQ, sex, parental education, parental sensitivity	Children born EPT with a disability or an IQ<97 had poorer social adjustment displayed by poorer global social outcomes (e.g. rather plays with adults than same age peers).[a] No difference between children born EPT with IQ>97 and children born at term
Scott et al., 2012	z=−6.5 z=−2.7	NC NC	6.9 1.4	2.3 to 20.8 0.6 to 3.3	<.001 .49	6	Sex, SES, ethnicity, neurosensory and cognitive disabilities	Children born EPT had poorer peer relations (interact and join in less) and more defiant/disruptive behaviour (p=.007) compared with their FT peers but not higher rates of clinically significant defiant disruptive behaviour[a]
Farooqi et al., 2007	NC	NC	Social problems 1.9 (parent) 2.9 (teacher) Withdrawal 2.9 (parent) 3.2 (teacher)	 0.8 to 4.6 1.1 to 7.6 1.3 to 6.6 1.3 to 8.0	 .14 .04 .01 .02	11	SES, family functioning, maternal mental health, chronic medical condition, sex	Social adjustment was poorer in children born EPT as rated by parent and teacher and was evidenced by more social problems (teacher report only) and withdrawal[a] No differences were found in terms of the rates of impaired family/peer relationships, or having few friends
Yau et al., 2013	1.07 (males) 0.2 (females)	0.3 to 1.9 −0.4 to 0.7	— —	— —	.009 .58	14	Sex, ethnicity, SES	ELBW males self-reported to be victimized more often than FT males.[a] There was no difference between ELBW and FT females, or the samples when both sexes were combined
Studies examining social competence within a global behaviour adjustment framework								
Theunissen et al., 2001	−5.6	NC	—	—	NR	1-4	Birthweight, sex, age, maternal and paternal education	No differences between groups in terms of achievement of social functioning
Delobel-Ayoub et al., 2006	—	—	2.1	1.4 to 3.1	<.01	3	SES, neonatal risks, neurodevelopmental status	Children born VPT more frequently had significant peer problems in comparison to children born at term. Children born EPT had the most peer problems of all groups[a]
Charkaluk et al., 2010	10	NR	—	—	<.01	2	NR	Children born VPT were rated by paediatricians to have poorer sociability than children born FT. VPT-born males were found to have lower sociability then VPT-born females

Table 3.3 continued

Baron et al., 2011	2.8	−0.6 to 6.2	—	—	NR	3	NR	Children born VPT did not display higher levels of withdrawal than children born at term
Treyvaud et al., 2012	0.8	0.3 to 1.3	—	—	.01	5	Cognitive ability and SES	Children born VPT displayed more peer problems[a]
Elgen et al., 2012	−0.8	−1.0 to -0.6	6.5	4.7 to 8.9	<.001	5	Neurodevelopmental disabilities, sex, maternal education	Children born EPT had more peer problems. Children born EPT with neurodevelopmental disabilities were at the highest risk[a]
Delobel-Ayoub et al., 2009	NR	NR	1.8	1.3 to 2.6	.001	5	SES, neonatal risks, cognitive performance and neurodevelopmental status	Children born VPT were significantly more likely to have peer problems than children born at term[a]
Reijneveld et al., 2006	0.6 (withdrawn) 0.7 (social problems)	0.4 to 0.8 0.5–0.9	1.7 2.6	0.8 to 3.6 1.4 to 5.2	<.05 <.05	5	Maternal education, sex	Children born VPT had higher social problem and withdrawn behaviour scores than children born at term.[a] However, VPT born children did not have higher rates of withdrawn behaviour than FT born children. Gender analyses showed that only VPT born females had higher withdrawal scores while only VPT born males showed more social problems.
Samara et al., 2008	1.2 (parent) 1.4 (teacher)	0.8 to 1.6 1.0 to 1.8	3.8 4.7	2.2 to 6.6 2.9 to 7.6	<.001 <.001	6	Cognitive impairment	Children born EPT were rated by parent and teacher as having more peer relationship difficulties compared with their FT peers. Children born EPT with cognitive impairment exhibited more peer problems than those with no cognitive impairment
Bora et al., 2011	0.8 (parent) 0.1 (teacher)	0.3 to 1.3 −0.4 to 0.6	2.5 1.3	1.2 to 5.3 0.5 to 3.2	<.01 .69	6	SES	Children born VPT were rated by parents as having more peer relationship difficulties than children born at term, but not by teachers[a]
Larroque et al., 2011	NR	NR	1.5	1.1 to 2.2	.03	8	SES, sex, and parity	Children born VPT were more likely to have peer problems than children born at term[b]
Anderson et al., 2003	−3.4 (parent) −4.8 (teacher)	−5.2 to −1.5 −6.3 to −3.2	— —	— —	<.001 <.001	8	Sex, birthweight, ethnicity, language at home, SES	Children born EPT had lower levels of leadership than children born at term when rated by both teachers and parents[a]
Hutchinson et al., 2013	0.6	0.2 to 1.0	—	—	<.01	8	SES, sex, and neurosensory disabilities	Children born EPT had poorer peer relations than children born at term[a]
Taylor et al., 2006	−8.5	5.8 to13.4	3.3	2.0 to 5.7	<.001	8	Sex, race, SES, resources, and stressors	ELBW children had poorer socialization skills than children of normal birthweight according to parents[a]
Bayless et al., 2008	−0.3	−0.9 to 0.4	—	—	.40	6–12	IQ	No differences were found between VPT and FT born children
Vederhus et al., 2010	-21.7 (boys) -1.8 (girls)	-35.1 to -8.3 -12.1 to 8.5			.01	10	Gender, physical activity, learning and/or attention problems	EPT males but not females were rated as having more social problems due to emotional and behavioural difficulties than their term-born counterparts

Note: VPT: very preterm (gestation <33wk); SES: socio-economic status; NR: not reported; NC: not able to be calculated; EPT: extremely preterm (gestation <28wk); FT: term-born (gestation between 38 and 42wk); ELBW: extremely low birthweight (<1000g). [a] Remained significant after statistical adjustment for confounding variables. [b] Did not remain significant after statistical adjustment for confounding variables.

Table 3.4: Social Performance Outcomes of Children Born VPT as Reported Across Studies Included in the Systematic Review

Reference	Results					Age at follow-up (y)	Confounders controlled for	Conclusion
	Mean difference	95% confidence interval	Odds ratio	95% confidence interval	*p*			
Studies with a primary social competence focus								
Spittle et al., 2009	NR	NR	—	—	NR	2	SES, multiple births	No significant differences were found between VPT and children born at term for prosocial behaviour
Jones et al., 2013	2.6	1.0 to 4.2	2.2	1.2 to 3.3	.005	4	SES, multiple births	Children born VPT were less likely to have positive play interactions with peers than children born at term. There were no significant differences in play disconnection or disruption. They were also found to have less synchronous interactions with their parents. Children born VPT with poorer cognitive development had poorer social performance[a]
Farooqi et al., 2007	— —	— —	Sport 4.3 Other 1.4	1.7 to 11.2 0.6 to 3.8	.004 .51	11	NR	Children born EPT were rated by parent and teacher as less involved in sport activities at home and school No significant differences were found in terms of participation in other activities and hobbies
Studies examining social competence within a global behaviour adjustment framework								
Delobel-Ayoub et al., 2006	—	—	1.5	1.1 to 2.1	.02	3	SES, health and development difficulties	Children born VPT were more likely to have poorer prosocial behaviour than FT peers. Children born EPT were at the highest risk. This remained significant after statistical adjustment for social risk but not after statistical adjustment for health and development difficulties.
Baron et al., 2011	−0.9	−4.1 to 2.3	—	—	NR	3	NR	Children born VPT did not have a poorer social performance in terms of (pro)social skills
Treyvaud et al., 2012	−0.2	−0.8 to 0.4	—	—	.52	5	Cognitive development, SES	No differences were found between VPT and children born at term for prosocial behaviour

Table 3.4 continued

Elgen et al., 2012	0.3	0.1 to 0.5	1.6	1.1 to 2.5	.02	5	Neurodevelopmental disabilities, sex, maternal education	Children born EPT were rated as having poorer prosocial behaviour compared with their term-born peers. This did not remain significant when children with neurodevelopmental disabilities or low cognitive ability were excluded
Delobel-Ayoub et al., 2009	NR	NR	1.4	1.0 to 2.7	.10	5	SES, neonatal risks, cognitive performance and neurodevelopmental status	No significant differences were found in children born VPT and at term for prosocial behaviour
Samara et al., 2008	−0.9 (parent) −1.2 (teacher)	−1.3 to −0.5 −1.7 to −0.7	4.5 5.0	1.9 to 10.3 2.3 to 11.0	<.001 <.001	6	Cognitive impairment	Children born EPT were rated by parent and teacher as having poorer prosocial behaviour compared with their term-born peers. Males born EPT were more likely to have pervasive prosocial problems than males born at term, and they had poorer prosocial behaviour than females born EPT[a]
Bora et al., 2011	−0.4 (parent) 0.0 (teacher)	−0.9 to 0.1 −0.6 to 0.6	1.3 0.9	0.6 to 3.2 0.4 to 2.2	.52 1.0	6	SES	No significant differences were found in children born VPT and at term for prosocial behaviour
Larroque et al., 2011	—	—	1.2	0.8 to 1.7	.43	8	SES, sex, and parity	No significant differences were found in children born VPT and at term for prosocial behaviour
Anderson et al., 2003	−2.4 (parent) −2.7 (teacher)	−4.3 to −0.5 −4.4 to 1.0	—	—	.01 .002	8	Sex, birthweight, ethnicity, language at home, SES	Teachers and parents rated children born EPT to have poorer prosocial behaviour (e.g. polite, helps others) than children born at term[a]
Hutchinson et al., 201	−0.4	−0.8 to 0.1	—	—	NR	8	SES, sex, and neurosensory disabilities	No significant differences were found in children born VPT and at term for prosocial behaviour
Bayless et al., 2008	0.6	−0.0 to 1.1	—	—	.06	6–12	IQ	No significant differences were found in children born VPT and at term for prosocial behaviour. Although, children born EPT with a low IQ were at the highest risk of poorer prosocial behaviour
Vederhus et al, 2010	—	—	3.2	1.0 to 10.8	.04	10	Gender, physical activity learning and/or attention problems	EPT-born children aged 10 years were found to be less involved in physical activities than their term-born peers

Note: VPT: very preterm (gestation <33wk); NR: not reported; SES: socio-economic status; EPT: extremely preterm (gestation <28wk); FT: term-born (gestation between 38 and 42wk). ELBW: extremely low birthweight (<1000g); NBW: normal birthweight. [a] Remained significant after statistical adjustment for confounding variables. #Did not remain significant after statistical adjustment for confounding variables.

However, all the four studies reporting no significant differences between VPT and term-born children also obtained low scores on our research quality assessment measure. Four additional studies assessed social adjustment during early and middle childhood. All used different standardized measures: Achenbach Child Behaviour Checklist, Behaviour Assessment System for Children, Brunet-Lezine Scale, and the Vineland Adaptive Behaviour Scale (Anderson et al., 2003; Charkaluk et al., 2010; Reijneveld et al., 2006a; Taylor et al., 2006). At age 2 years, children were found to have less sociability when rated by paediatricians (p<.001; Charkaluk et al., 2010). At age 5 years, children born VPT had more social problems and withdrawal than their term-born peers ($p < 0.05$; Reijneveld et al., 2006); and at age 8 years, children of ELBW also showed less leadership and poor socialization skills than their term-born peers ($p < .001$; Anderson et al., 2003; Taylor et al., 2006). Finally, at age 10 years, EPT males but not females were rated as having more social problems due to emotional and behavioural difficulties than their term-born counterparts (Vederhus et al., 2010a).

Taken together, these social adjustment findings highlight that, in early childhood, children born VPT are more likely than their term-born peers to have emotional and/or behavioural problems (e.g. demanding, impulsive, negative emotions) that can lead to difficulties in relating to others. Findings also suggest that these problems often persist into middle childhood and adolescence, presenting most commonly as social withdrawal. No evidence was found to suggest that children born VPT are more hostile or aggressive.

Social performance. Table 3.4 describes the social performance of children born VPT. Overall 15 out of 23 studies assessed social performance, defined as interpersonal behaviour appropriate to the social setting. Social performance outcomes included prosocial and play behaviour and social engagement such as involvement in sport/leisure activities.

Three primary social competence studies examined social performance outcomes (Farooqi et al., 2007; Jones et al., 2013; Spittle et al., 2009). At preschool age, the Australian study found children born VPT had similar levels of prosocial skills as term-born children (Spittle et al., 2009a). However, also at preschool age, the New Zealand study found that children born VPT were characterized by lower levels of positive peer play ($p = .04$) and less synchronous interactions with parents ($p = .05$; Jones et al., 2013). No significant between-groups differences were evident for play disruption or disconnection. Similarly, in the Swedish study of 11-year-olds, children born EPT were rated by their parents as less likely to be involved in clubs, organizations, and teams ($p = .007$) than term-born children (Farooqi et al., 2007). No significant differences were found in the level of participation in hobbies or other activities.

Of those studies (12/16) examining social performance outcomes as part of a general developmental evaluation, nine from early childhood through to pre-adolescence were based on the SDQ Prosocial Behaviour subscale. Findings were mixed, with significant differences between VPT and term-born children found in three studies, with these between-groups differences tending to be reported for children born EPT and/or with intellectual impairment. Results from a study using parent report from the Behaviour Assessment System for Children showed similar levels of prosocial behaviour in VPT and term-born children during early childhood (Baron et al., 2011). However, based on teacher report using this same measure, children born EPT were found to have poorer prosocial behaviour (e.g. being less polite or less likely to help others) at age 8 years (Anderson et al., 2003). Furthermore, EPT-born children aged 10 years were found to be less involved in physical activities ($p = .04$) than their term-born peers, supporting findings from the Swedish study (Vederhus et al., 2010a).

Social skills. As shown in Table 3.5, four reviewed studies examined social skills of children born VPT, defined as cognitive and behavioural skills pertinent to the development of social competence such as attention, cooperation, interpretation of body language, social-cognitive processing, and emotion regulation. All of these were primarily studies of social competence (De Schuymer et al., 2011; Jones et al., 2013; Scott et al., 2012; Spittle et al., 2009a). The Belgium study found that, at age 6 months, children born VPT smiled and vocalized less than term-born children when rated by blind-raters, although this difference was not found at 3 or 9 months of age (De Schuymer et al., 2011). The Australian study found that, based on parent report, 2-year-old children born VPT were less compliant, had poorer attention (focused and sustained), imitation (interest in nurturing others, imitating social behaviours), and mastery motivation (persistence, pleasure following success; Spittle et al., 2009a). The New Zealand study found that, at age 4 years, children born VPT were less effective in regulating their emotions than term-born children based on parent and blind-tester assessments ($p < .01$; Jones et al., 2013). Specifically, they were characterized by more mood swings, disruptive outbursts, fussiness/upset, and difficulties regulating excitement. However, no significant between-group differences were evident for social-cognitive processing assessed using theory of mind tasks. Similarly, the American study found that at age 6 years, children born EPT were rated by their teachers as having poorer self-management and compliance skills (e.g. ability to control feelings, empathy, cooperate) than term-born children ($p < .001$; Scott et al., 2012). However, this difference did not persist when children with neurosensory disabilities or intellectual impairment (<10th centile score) were excluded. Overall, these preliminary findings suggest that VPT-born children aged 2 to 6 years tend to display poorer cognitive and behavioural

skills that are required in social interactions such as compliance, emotion regulation, and attention, with these problems being more prominent in children with intellectual impairment.

Neonatal predictors of social competence. Despite the importance of understanding the mechanisms that may place children born VPT at risk of social competence problems, studies examining this issue are scarce. Two primary social competence studies examined associations between neonatal biological and social risk factors and later child social competence outcomes (Jones et al., 2013; Spittle et al., 2009a). Results showed that, at age 2 years, low birthweight, postnatal corticosteroid use, and cerebral white matter abnormalities were associated with parent-reported social competence problems (Spittle et al., 2009a). This study found females to be at increased risk of social competence problems. In addition, the New Zealand study showed family socio-economic disadvantage, EPT birth, cerebral white matter abnormalities on magnetic resonance imaging at term, and early childhood exposure to high levels of maternal anxiety and negative parenting were associated with elevated risk of social competence problems at age 4 years (Jones et al., 2013). Conversely, this study found males to be at increased risk of social competence problems. A further three studies of general behavioural outcomes reported similar results. The first study reported longer duration of intubation and lower parent education as predictors of poorer sociability in VPT-born children at age 2 years (Charkaluk et al., 2010). In another study, children born outside the neonatal centre, or born with grade III/IV intraventricular haemorrhage, and/or jaundice, as well as those with lower family SES and/or level of resources, were associated with poorer socialization skills at age 8 years (Taylor et al., 2006). Similarly, postnatal steroid exposure for bronchopulmonary dysplasia predicted poor social functioning in 10-year-old males born EPT (Vederhus et al., 2010a).

3.3 Discussion

This systematic review has examined the nature and development of social competence in children born VPT, as well as the factors that may increase their risk of social competence problems. Most studies included in this review narrowly examined only one or two aspects of social competence, with some conceptualizing social competence as synonymous with socio-emotional and behavioural adjustment. In addition, there was little consensus across studies about key social competence constructs. To help synthesize existing research, we adopted the tri-component model to provide a systematic conceptual framework and organize relevant studies for this review.

The general consensus across reviewed studies was that children born VPT are at increased risk of social competence difficulties throughout childhood and adolescence. Several

Table 3.5: Social Skills Outcomes of Children Born VPT as Reported Across Studies Included in the Systematic Review

Reference	Results					Age at follow-up (y)	Confounders controlled for	Conclusion
	Mean difference	95% confidence interval	Odds ratio	95% confidence interval	*p*			
Studies with a primary social competence focus								
De Schuymer et al., 2011	NR	NR	NR	NR	NR	6mo	NR	FT infants were found to smile and vocalize more than VPT infants. Although this was not significant at 3 or 9mo. At age 9mo, VPT infants followed the gaze of the experimenter less than FT infants. There were no other differences in dyadic and triadic skills between groups suggesting that VPT infants have the same sensitivity to contingency in most skills for social interactions as FT peers
Spittle et al., 2009	−0.1 (compliance) −0.2 (attention) −0.1 (imitation/play) −0.1 (mastery motivation) −0.2 (empathy)	−0.2 to 0.0 −0.3 to −0.1 −0.2 to −0.04 −0.2 to −0.0 −0.3 to −0.1	NR NR NR NR NR	NR NR NR NR NR	.05 .002 .03 .01 .001	2	SES and multiple births	Children born VPT demonstrated poorer social skills in terms of compliance, attention, play, mastery motivation, and empathy compared with FT peers.[a] A higher proportion of children born VPT were also in the clinical range than FT born children although this did not persist when controlled for SES
Jones et al., 2013	4.8 (emotion regulation) −0.2 (social cognition)	2.4 to 7.1 -0.4– 0.1	2.1 —	1.2 to 3.7 —	.001 .43	4	SES, multiple births	Children born VPT had poorer social skills in terms of emotion regulation, but not social cognition compared with FT peers[a]
Scott et al., 2012	−3.1	NC	1.9	0.7 to 5.6	.002	6	Sex, SES, ethnicity, neurosensory and cognitive disabilities	Children born EPT had poorer social skills of self-management and compliance as rated by teachers but not higher rates of significant problems[b]

Note: NR: not reported; FT: term-born (gestation between 38–42wk); VPT: very preterm (gestation <33wk); SES: socio-economic status; NC: not able to be calculated; EPT: extremely preterm (gestation <28wk). [a] Remained significant after statistical adjustment for confounding variables. [b] Did not remain significant after statistical adjustment for confounding variables.

Table 3.6: Researched Areas of Social Competence for Children Born VPT Compared with Children Born at Term Categorized According to Age-Appropriate Development and Social Difficulties Across Developmental Stages

Early childhood (0–5y)	
Age-equivalent skills	**Social difficulties**
Most dyadic and triadic skills in infancy	At age 6mo, dyadic skill of smiling and vocalizing
Theory of mind	At age 9mo, triadic skill of gaze following
Play disruption/play disconnection	Emotional problems
Play happily, confident, not withdrawn [b]	Inattention/hyperactivity
Prosocial behaviour (BASC, ITSEA)	Poor inhibitory control
Social cognitive processing	Less positive peer play and less synchronous parent interactions
	Social maladjustment (plays with adults than peers, solitary play, hard to be away from home/dependent on parents, critical in contact with others, difficulty following rules and playing games, destroys playing situations)[a]
	Prosocial behaviour (SDQ)[b]
	Peer relationship difficulties
Middle childhood (6–9y)	
Age-equivalent skills	**Social difficulties**
No increase in hostile, irritable, antisocial, aggressive behaviours.	Social problems
Prosocial behaviour (SDQ and BASC)	Withdrawal
	Poorer leadership
	Defiant/disruptive behaviour
	Less interactive
	Peer relationship difficulties
	Poor self-management/compliance [a]
	Poorer social skills
Pre-adolescence (10–12y)	
Age-equivalent skills	**Social difficulties**
Involvement in hobbies, social activities	Peer relationship difficulties
No more aggressive delinquent behaviour	Social withdrawal
Prosocial behaviour (SDQ)	Less involved in clubs, organizations, teams, physical activities
	Fewer friends, more impaired peer relationships [c]
Adolescence (13–17y)	
Age-equivalent skills	**Social difficulties**
	Victimized more often (males only)

Note: y: age in years; BASC: Behavioural Assessment System for Children; ITSEA: Infant–Toddler Social and Emotional Assessment; SDQ: Strengths and Difficulties Questionnaire. [a] When combined with lower cognitive ability. [b] Low-quality study. [c] $p<0.06$.

developmental trends were also evident. First, social adjustment difficulties in children born VPT emerge early and persist into adolescence. These difficulties tend to manifest as social withdrawal and peer relationship problems, but not aggressive/antisocial behaviour. EPT-born children or those born VPT with low intellectual ability, and males appear to be especially prone to these problems. Second, less consensus exists about the social performance of children born VPT, although there is evidence of poorer interpersonal behaviour in terms of play interactions in early childhood and less involvement in team sport activities during pre-adolescence. The development of prosocial behaviour has been reported to be less age-appropriate in young children born VPT based on measures other than the SDQ. When measured using the SDQ, prosocial behaviour was comparable in middle childhood, which contrasted with results of studies with a primary social competence focus. This may suggest that, by middle childhood, children born VPT catch up with their term-born peers in levels of prosocial behaviour. However, studies that included only EPT samples were more likely to find significant group differences in levels of prosocial behaviour at any age relative to their term-born peers, which may highlight that those with the earliest

gestational ages at birth may be at increased risk of poor social performance. This may also reflect the nature of the measures and informants used (e.g. only parent report) and suggests that further study is needed, ideally with multi-informant report on measures of observable prosocial behaviour. Third, in terms of social skills, although existing research suggests that social-cognitive processing may be spared in children born VPT, at least during early childhood, poor development of other social skills such as emotion regulation and compliance are evident as early as 2 to 4 years old in children born VPT.

Those at highest risk of poorer social competence throughout childhood were children born at an early gestational age (i.e. EPT), were male, and who had lower intellectual functioning. It is not yet clear at what level of cognitive functioning social competence is affected and how. Furthermore, research suggests that cognitive functioning may be more influential than physical disability. One interpretation is that cognitive ability influences a child's capacity to develop basic social skills, such as emotion regulation, reading cues, and body language, creating a less satisfying social interaction for peers. Relatedly, other children may be more accepting of social interactions with a peer with a physical disability relative to a cognitive disability. Future research needs to distinguish whether children born VPT are more withdrawn than term-born children as a result of peer rejection or as a result of their own preferences and/or skill deficits.

This review also identified several important methodological issues that need to be taken into account both in the interpretation of findings and in future study design. First, despite the availability of evidence-based observational and sociometric methods suitable for assessing social competence, most existing studies have been based on screening measures. Relying solely on these measures is somewhat problematical since some of these scales do not take into account the developmental needs of these high-risk children. For example, the Child Behaviour Checklist in part assesses social competence based on the child's level of participation in sport activities. Thus, lower rates of sports involvement due to a motor impairment may confound the measurement of social competence with these tools. Second, a related measurement issue concerns the over-reliance on information from a single report source, typically the parent. Previous studies have shown that this may result in under- or overestimation of child behaviour problems. Obtaining information about child social functioning from multiple, independent sources is a more reliable and valid approach (Bora et al, 2011). Self-report from children themselves and their peers could also provide useful information about their social competence. Third, the lack of longitudinal evaluation makes it difficult to understand the developmental trajectory of social competence in these high-risk children. Finally, it is noteworthy that almost half of the studies reviewed focused only on higher-risk children born EPT, limiting understanding of the impact of varying degrees of

gestational immaturity on the development of later social competence problems. It is further recommended that future studies report all necessary data (such as birthweight, gestation, and means), and define and describe their social terms and measures, so that meta-analyses can be conducted.

A final issue addressed by this review concerned the identification of neonatal and social factors that placed children born VPT at social competence risk. This is important for the early identification of those at greatest risk of experiencing social problems that may impede their ability to form positive social relationships, succeed at school, and traverse difficult social situations in sport, leisure, and work. Only four studies addressed this issue, suggesting that both medical/biological and socio-familial factors play some role. In particular, cerebral white matter abnormalities identified on magnetic resonance imaging scans at term and the family social context including social disadvantage, maternal anxiety, and negative parenting appear adversely to affect the development of social competence in children born VPT. Further research is needed to extend and confirm these preliminary findings. Although most findings remained significant while controlling for family SES, children born VPT who were from higher social risk backgrounds were at increased risk of social difficulties. Given that VPT samples tend to be of lower SES, this highlights the cumulative effect that neurodevelopmental and environmental factors can have on the social development of these children. This is consistent with findings from existing VPT research in other domains (Delobel-Ayoub, Kaminski, Marret, Burguet, Marchand, N'Guyen, Matis, Thiriez, Fresson, Arnaud, Poher, Larroque, & Group, 2006; Farooqi et al., 2007; Gross, Mettelman, Dye, & Slagle, 2001; Solaski, Majnemer, & Oskoui, 2014; Wong & Edwards, 2013). It is likely that these measures of social risk are markers for other, more influential, family problems that may negatively affect a child's social development such as poor parenting, higher parental stress, less resources/opportunity, and so on. Thus, in future studies, there needs to be closer examination of other more proximal family factors that may be related both to family SES and to the development of social competence. This valuable information would then inform intervention strategies.

From a clinical perspective, findings from this review emphasize the need to include an assessment of social functioning in the screening and developmental follow-up of children born VPT. Given the important role of parents in shaping a child's behaviour, if difficulties are identified, several clinical strategies could be used to guide the modelling of social behaviour and appropriate reinforcement of successful child social behaviours. Research suggests that these interventions for increasing social skills might be supplemented with other child-friendly interventions such as cognitive behavioural therapy and distress tolerance techniques to increase

the effectiveness of such interventions (Beelman, Pfingsten, & Losel, 1994; Ogilvy, 1994). These techniques may serve to provide children born VPT with the additional required cognitive, emotional, and behavioural skills to engage in social interactions effectively that are not taught through social skills training alone (Beelman et al., 1994; Ogilvy, 1994). Furthermore, research suggests that the most effective interventions for increasing children's social competence are those that extend systematically to the children's family and school (Ogilvy, 1994). Therefore, parenting training to increase warm responsive parenting and decrease coercive punitive parenting may also be effective for children experiencing how to regulate their emotions with their parent's help, and to observe and practice appropriate social interactions. Programmes such as Incredible Years, Early Start, or Triple P may be useful intervention strategies, which incorporate these ideas and provide a support network for children and families, particularly for families identified as having poor cohesion, high levels of stress, parents with mental health difficulties, and/or poorer parenting skills (de Graaf, Speetjens, Smit, de Wolff, & Tavecchio, 2008; Menting, Orobio de Castro, & Matthys, 2013; Webster-Stratton & Reid, 2004a). Programmes such as Incredible Years directly address social competency difficulties by teaching children, for example, how to talk to and make friends, work in groups, communicate, and cooperate. They also teach parents how to support their children in the development of skills (Webster-Stratton & Reid, 2004a). School-based interventions that address cognitive, behavioural, affective, and social skills may also serve as an important option going forward given the rise in children born VPT surviving and entering school. Parents, teachers, or service providers, such as psychologists, can positively influence an at-risk child's social competence by guiding the child, and giving advice and feedback, by providing opportunities for social interaction and prompting appropriate behaviours during the encounter, and by teaching children about their emotions so that they can understand and cope with them as well as interpret how peers may be feeling. Future research needs to examine the impact of poor social competence during childhood on the longer-term social, occupational, and family functioning of these high-risk children.

"She has found it hard to make friends at school. She has a quiet personality, is naïve and has difficulty holding social conversations."

- ***Parent of EPT born female (born at 27 weeks gestation).***

Chapter Four
Aims and Hypotheses

The literature review presented in the previous chapter provides evidence that children born EPT are at elevated risk of poor social outcomes compared to children born FT. VPT born children appear to be at less of an elevated risk than the EPT born children. The review further suggests that this elevated risk likely spans across childhood with evidence of differences from as early as two years of age through to pre-adolescence. However, as noted, existing studies have been limited by a number of issues including reliance on single informant data, use of brief screening tools, lack of child or peer report, cross-sectional analysis and absence of a guiding conceptual model. Therefore, the overall goal of the present thesis was to address these issues and examine a range of important questions relating to the social development of children born EPT and VPT. Specific aims and hypotheses are described below.

Section 1: Friendship and Peer Relationship Experiences of Preadolescent Children Born Extremely Preterm and Very Preterm

These aims and hypotheses will be explored in Chapter Six of this thesis.

Aim One: To describe the between-group differences in the social adjustment of preadolescent children born EPT (<28 weeks gestation) and VPT (<32 weeks gestation) relative to their FT peers at age 12 years. Social adjustment functioning includes the nature of the children's friendships such as number of friendships, satisfaction with number of friends, quality of best friendship, age of best friend and duration of best friendship. Level of interaction with friends was also included in this chapter despite it being a social performance outcome. Social adjustment also includes the nature of their relationship with their wider peer group such as how connected and

included they feel with peers, the level of problems they have with their peers and how victimized they are by their peers.

Hypotheses:

- Children born EPT/VPT will have fewer friends, will be less satisfied with the number of friends, and will have lower quality friendships than FT born children. It is hypothesised that EPT and VPT born children will show less frequent social interactions with friends.
- It is hypothesised that children born EPT and VPT will have more negative social outcomes with their peers than children born FT. Specifically, children born EPT/VPT will receive more victimisation from peers, and have more peer problems than children born FT. As a result they will also feel less connected to their peers than FT born children.

Aim Two: To identify family social background and 12-year concurrent child characteristics associated with poorer social adjustment within a large sample of all three groups pooled together.

Hypotheses:

- Family characteristics hypothesized to be associated with poorer social development based on previous research and theory will include*:* lower SES; younger maternal age; lower levels of maternal education and lower resources.
- Child characteristics hypothesized to be associated with poorer social development based on previous research and theory will include*:* sex, lower intelligence; children with more physical differences and/or visible health concerns; children with poorer motor ability and more academic, emotional and/or hyperactivity problems.
- Birth status will not be statistically significant once additional developmental factors are included in the analysis.

Section 2: Social Skills and Social Performance of Preadolescent Children Born Extremely Preterm and Very Preterm

These aims and hypotheses will be explored in Chapter Seven of this thesis.

Aim Three: To examine the between-group differences of the EPT, VPT and FT born children on the two lower components of the tri-component model, social skills and social performance at age 12 years. Social skills include interpersonal skills and socio-cognitive skills (attachment and rejection sensitivity). Social performance includes prosocial behaviour, and aggressive behaviour.

Hypotheses:

- It is hypothesised that children born EPT and VPT will have poorer interpersonal skills and socio-cognitive skills than their FT born counterparts.

- Research indicates that those born at younger gestational ages (EPT) will have more difficulty with their prosocial behaviour than FT born children. EPT and VPT born children will not have more aggressive behaviour in terms of bullying others.

Aim Four: With the three gestational groups pooled together, the current study aimed to examine the role of the social skill and social performance components of the tri-component model in explaining the between-group differences seen for the 12-year social adjustment outcomes. In doing so, the current study examined whether social skill and social performance variables were independently associated with and explained the between-group differences in social adjustment outcomes over and above the effects of prematurity.

Hypotheses:

- Poorer social skill and social performance abilities at age 12 years will negatively impact on their social adjustment outcomes leading to more peer problems and victimization. The tri-component model will be supported.
- Birth status will not remain statistically significant with the inclusion of social skill and social performance variables in the regression analysis.

Aim Five: Then, subsequent to Aim Four, the current study aimed to examine the combined role of the associated child and family variables (from Aim Two) and the social skill and social performance variables (from Aim Four), in order to determine the most influential associated factors that explain the between-group differences seen for the 12-year social adjustment outcomes.

Hypotheses:

- Social skill and social performance variables when combined with the child and family characteristics identified in Aim Two will explain more variance of the social adjustment outcomes.
- Social skills and social performance variables will still be related to social adjustment outcomes when the child and family factors are included in the model.
- Birth status will no longer be statistically significant after the inclusion of these social, child and family variables.

Section 3: The developmental trajectory of social competence in children born EPT and VPT

These aims and hypotheses will be explored in Chapter Eight of this thesis.

Aim Six: To examine longitudinally the development of peer problems in children born EPT and VPT in comparison to FT born children at age 4, 6, 9 and 12 years.

Hypotheses:

- EPT born children will have the poorest trajectory of peer problems out of the three groups. The EPT born children will show difficulties throughout childhood and into pre-adolescence. These difficulties will increase over time for the EPT born children.
- VPT born children will have fewer social difficulties but will still have more than FT born children at all follow-up ages. It is hypothesised that over time these children will be similar to the FT born children.
- FT born children will have the least amount of peer problems over time and difficulties will remain stable for this group over time (i.e. not increase).

Aim Seven: To longitudinally identify risk and resilience factors at age 4 years that may predict poor peer relationships at age 12 years. Groups will be pooled for this analysis with an aim to identify factors that will be independently associated with having peer relationship difficulties at age 12 years over and above the effects of prematurity.

Hypotheses:

- Child characteristics at age 4 years such as intelligence, motor development, verbal skills, behavioural and emotional regulation, emotional difficulties, peer problems, and hyperactivity/inattention will be associated with peer relationship difficulties at age 12 years.
- Family functioning variables at age 4 years such as SES, parenting style, family instability, and maternal mental health will be differentially related to child's outcome of social competence. It is hypothesised that low family SES, early experiences of intrusive, unsupportive parenting, and less parent-child synchrony, family instability, and higher levels of maternal anxiety and depression will be associated with peer problems at age 12 years.

"I feel all alone and have no one to turn to"

- Male participant born EPT (26 weeks)

Chapter Five
Research Design

This thesis is an extension of the Canterbury Preterm Study, a prospective longitudinal study which sought to investigate the developmental outcomes of a regional cohort of children born VPT between the years 1998 and 2001 in Canterbury, New Zealand. This chapter provides a description of the longitudinal study with detailed explanation of the research design for the 12-year follow-up, which was the focus of this thesis. The participants will be described first followed by a general description of the study procedure. Next, this section will provide an overview of how the tri-component model was used as a framework for measurement of social competence. Finally, a brief description of how the data was managed concludes the chapter. The results chapters in this thesis are formatted as paper publications so more detailed descriptions of the procedures, measures and analyses used for the individual studies in this thesis are provided in the appropriate sections of the subsequent results chapters.

5.1 Participants of the Canterbury Preterm Study

5.1.1 The children born VPT. The first group of participants recruited consisted of a regional cohort of children born EPT and VPT (< 33 weeks of gestation; n = 110) who were consecutively admitted to the level III Neonatal Intensive Care Unit (NICU) at Christchurch Women's Hospital in Canterbury, New Zealand, between July 1998 and February 2001. This NICU is the sole-service provider for at-risk neonates in the greater Canterbury region. After admission to the NICU the parents of every EPT/VPT infant were approached by a research nurse and invited to participate in the study. Exclusion criteria included: infants with congenital abnormalities; foetal alcohol syndrome; and/or non-English speaking parents. Figure 5.1 displays the recruitment process at birth and the retention rates of the prospective longitudinal regional cohort study up to age 12 years. In total, of all eligible infants (n = 129), 92% (n = 110) were recruited. Reasons for non-participation included: refusals (n=5); death (n=10); and missed recruitment (n = 4). There were no

differences found between the neonatal or social background characteristics of those who participated and those who refused (p>.05). For the purposes of the current study, this recruited group was split into two groups: those born EPT (<28 weeks gestation; n = 44) and those born VPT (n = 60).

Of all eligible 12 year old EPT and VPT born participants (n = 110), 95% (n = 104) completed the 12-year study and complete data was obtained for 89% of the 110 eligible EPT and VPT participants. The sample was regionally representative and there were no significant differences in background characteristics between those who completed the 12-year follow-up and those who did not (p > .05).

5.1.2 The children born FT. A control group of infants born FT (38-41 weeks of gestation) was recruited as a comparison group. To begin with, a small group of FT born infants (n = 10) was recruited at birth when the EPT and VPT born infants were recruited. When the EPT/VPT born children reached two years of age, a larger group (n = 103) of FT born children was recruited resulting in a control group with a total of 113 infants born FT. The FT born participants at both recruitment stages were randomly selected from hospital birth records (N = 7,200 live births) over the same birth period (1998-2001) as the EPT/VPT born infants and matched to the EPT/VPT infants for sex, birth date and place of birth. Every FT born participant was selected by alternatively inviting the previous or the following infant of the same sex in the delivery register for each EPT/VPT born participant.

In line with the EPT/VPT sample, FT born infants with congenital anomalies, foetal alcohol syndrome, and/or non-English speaking parents were also excluded. If exclusion occurred while selecting the FT group, the next suitable matched child in the birth register was selected. The parents of eligible FT born participants were telephoned by research staff and invited to participate in the study.

As seen in Figure 5.1, of all 177 eligible infants, 62% were recruited at age two years (n = 103).Reasons for nonparticipation included: inability to trace (n = 30); refusal (n = 8); moved overseas (n = 8); or agreed but could not attend the assessment within the 2-week assessment timeframe (n = 18). There were no significant differences between participating and non-participating FT infants in terms of gestational age at birth, birth weight, sex, parental relationship status, minority ethnicity, and SES (p > .05). However, non-participating FT infants had mothers who were older (p < .001). Despite this, regional census data (Statistics New Zealand, 2001) indicated that the socioeconomic profiles of the families of the FT born infants (assessed at age two years) were representative of the families living in the Canterbury region. Of all 113 eligible FT

participants, 109 (96%) completed the 12-year follow-up assessment with complete data being collected for 104 children (92% of all eligible cases; see Figure 1).

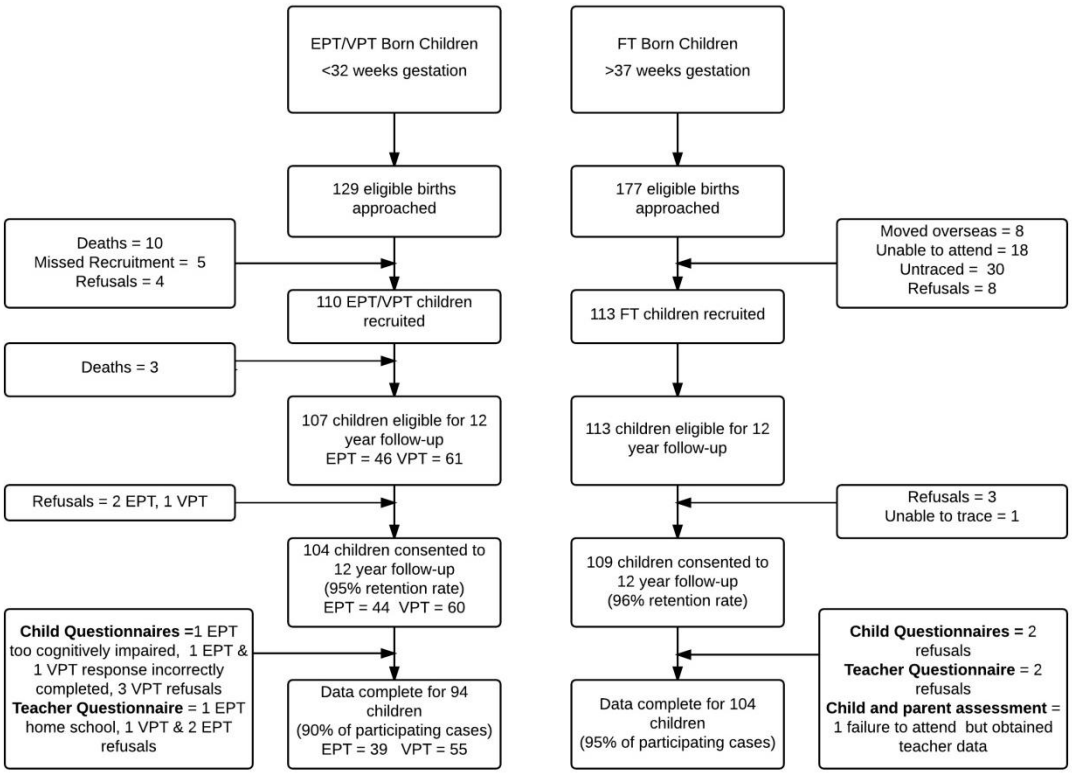

Figure 5.1: Recruitment and Retention of Participants in the Canterbury Preterm Study

5.1.3 Sample characteristics of all children. The infant clinical and social background characteristics of the three study groups are displayed in Table 5.1. There were no differences in terms of the proportions of males and females in each group. Infants born EPT/VPT had significantly lower gestational age and birth-weight, and were more likely to be a twin than FT born infants ($p < .05$). Except for presence of intrauterine growth restriction (IUGR), neonatal clinical characteristics of the FT group were unavailable so only EPT and VPT participants were compared on the remaining neonatal clinical variables. Infants in the EPT and VPT groups experienced a high rate and range of neonatal clinical complications. For example, the EPT and VPT groups experienced more IUGR than FT infants (15.9% and 6.7% versus 0.6%, respectively; $p < .001$) and had high rates of patent ductus arteriosus (PDA; 70.5% and 28.3%, respectively). Although infrequent, the rate of intraventricular haemorrhage (IVH) grade ¾ and/or cystic periventricular leukomalacia (PVL) increased with decreasing gestational age. This is consistent with previous findings in preterm samples (e.g. Donat, Okazaki, Kleinberg, & Reagan, 1979). EPT born infants had high usage rates of oxygen therapy at 36 weeks (65.9%), postnatal dexamethasone use after birth

(11.4%), necrotising enterocolitis (18.2%), and proven sepsis (43.2%). Both EPT and VPT groups had high rates of maternal antenatal corticosteroid use (90.9% and 83.3%, respectively; p<.001). Except for diagnosis of IVH and/or PVL and maternal use of antenatal corticosteroids, EPT born children had significantly more of these perinatal complications than the VPT born children demonstrating their increased neonatal morbidity (p < .05). Appendix B describes each of these clinical characteristics and why they are important to describe in EPT/VPT samples.

Table 5.1: Infant Clinical and Social Background Characteristics of Participants Born EPT, VPT and FT

Measure	Birth Group EPT (n = 44)	VPT (n = 60)	FT (n = 109)	F/X^2	p
Infant clinical characteristics					
Gestational age, *M*±*SD,* weeks	25.6±1.5	29.5±1.3	39.5±1.2	2334.0	.00
Birth weight, *M*±*SD,* grams	798.5±231.3	1242.4±226.3	3584.6±411.5	1537.6	.00
ELBW (< 750 grams), %	81.8	15.0	0.0	127.1	.00
Single birth, %	72.7	63.3	96.3	32.1	.00
Male sex, %	45.5	53.3	54.1		.64
Intrauterine growth restriction, %	15.9	6.7	0.9	13.4	.001
Patent ductus arteriosus, %	70.5	28.3	-	18.1	.00
Intraventricular haemorrhage Grade III or IV and/or, Cystic periventricular leukomalacia, %	15.9	6.7	-	2.29	.20
Oxygen at 36 weeks, %	65.9	13.3	-	30.6	.00
Postnatal dexamethasone use, %	11.4	1.7	-	4.4	.04
Necrotising enterocolitis, %	18.2	1.7	-	8.8	.00
Proven Sepsis, %	43.2	11.7	-	13.4	.00
Antenatal corticosteroid use, %	90.9	83.3	-	1.25	.26
Social Background Characteristics					
Minority Ethnicity, %	18.2	11.7	12.0	1.2	.55
Maternal Age, *M*±*SD,* years	30.7±6.1	30.7±5.1	31.1±4.4	0.2	.85
Single parent at birth, %	22.7	16.7	12.0	2.8	.25
Socioeconomic status*					
Low %	27.3	33.3	10.1		
Medium %	47.7	41.7	54.0		
High %	25.0	25.0	34.9	14.7	.005
Mother did not graduate high school, %	34.1	45.0	18.3	13.7	.001

Notes: EPT: Extremely Preterm, VPT: Very Preterm, FT: Full-Term; M: Mean; SD: Standard Deviation * Measured by Elley-Irving scale (Elley & Irving, 2003). Higher code indicates lower socio-economic status.

The social background characteristics of the three study groups are also displayed in Table 5.1. There were no differences between groups in terms of maternal ethnicity, maternal age, or single parenthood at birth (p > .05). However, as well as increased neonatal morbidity, infants in the EPT and VPT groups were significantly more likely to be of low SES and to have mothers who had a low level of education, compared to FT born children (p < .05). This is also a common finding of EPT and VPT samples (Cavazos-Rehg et al., 2014; Smith, Draper, Manktelow, Dorling, & Field, 2007).

5.2 Procedure of the Canterbury Preterm Study

A broad overview of the research design of this longitudinal study over the years is provided in Figure 5.2. The research protocols for each follow-up assessment were all approved by the Canterbury Regional Ethics Committee.

5.2.1 Recruitment. At recruitment, comprehensive neonatal data were collected from the medical records and hospital database for all participating children. In addition, at the same time parents or guardians were interviewed about the family characteristics and circumstances by a research nurse. Finally, in the infants first six weeks of life, a bedside serial cranial ultrasound was performed several times (more frequently for those with abnormalities). These scans were graded for the presence and extent of brain injuries, namely, PVL and IVH.

5.2.2 Follow-up assessments. As illustrated in Figure 5.2, the two groups of children were invited to partake in follow-up assessments at ages 2, 4, 6, 9, and 12 years. The retention rates for each stage of the follow-up are also displayed in Figure 5.2 and were excellent at all time-points. At the majority of these follow-up assessments, the EPT/VPT born children's ages were corrected for extent of prematurity (i.e. their age was calculated from their expected due date, not the date of their preterm birth) [2]. Age correction is common practice in the VPT literature (Hack, Klein, & Taylor, 1995; Restiffe & Gherpelli, 2006). It is done so the EPT/VPT born children are compared to their actual age norms had they been born FT which allows a more accurate comparison of their performance to be measured against the FT born children.

In all possible circumstances, families attended these follow-up assessments at a research facility at the Christchurch campus of the University of Canterbury. If participants travelled from outside of Christchurch to attend this assessment they received compensation for travel and accommodation costs. All assessments were video-recorded in order to ensure consistent administration and scoring of tasks. The research facility contained a waiting area for the caregivers and/or family members where they could watch the child over closed circuit television (CCTV), as they completed the assessment. If twins were to be assessed, they were assessed on the same day by different researchers in different rooms of the research facility when feasible. Researchers kept the CCTV turned off when either twin took a break and the twins were not allowed to discuss test material. If twins could not be seen on the same day, they were seen on consecutive days.

[2] The 9 year follow up assessment was not age-corrected.

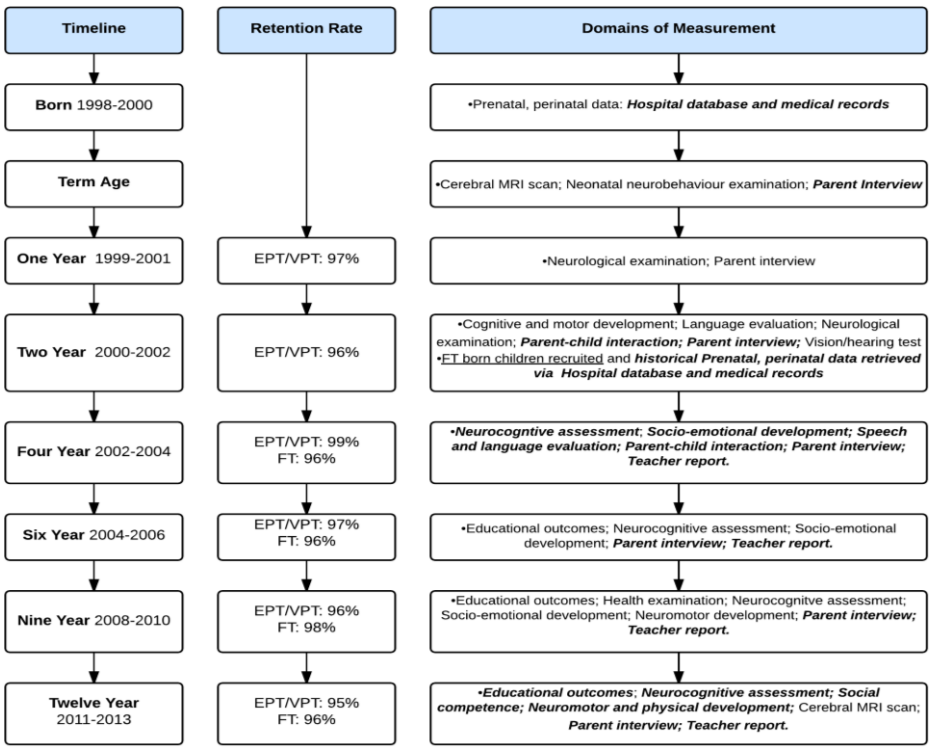

Figure 5.2: Overview of the Canterbury Preterm Study research design. *Bold and italic font* indicates data collection relevant to this thesis.

5.2.3 General follow-up assessment procedure. At the time of each follow-up, children born VPT and FT were contacted via letter and telephone and invited to participate in the upcoming assessment. Willing participants were asked to bring anything the child may need for optimal testing conditions (such as lunch, glasses, or hearing aids). The participants attended follow-up neurodevelopmental assessments which were carried out by a multidisciplinary team, within a two-week window of the child's birth date or the expected date of delivery (after age correction was applied).

At the beginning of every follow-up assessment, guardian consent and child assent was obtained. Time was allowed for questions from the participating family and this introductory time aimed to help the participants to feel comfortable with the researchers. All children were offered breaks at standardised times throughout the assessment or when they seemed to fatigue significantly. Breaks were five to ten minutes long and consisted of a snack, informal conversation and/or toilet stop and children were welcome to talk to their guardians and/or go outside.

The follow-up assessments required the child to complete various neurodevelopmental tests in a standardised order while the parent(s)/guardian(s) was/were interviewed about family circumstances and their child's development. All data collection was completed by researchers that were blind to the children's birth group status. Additional to the neurodevelopmental assessment,

from the four year follow up and onwards, teachers of all study children were asked to complete a questionnaire about the child's academic progress and socio-behavioural development subsequent to the child's follow-up assessment. This questionnaire was posted to the children's teachers and on return of the completed questionnaire, they were sent a coffee voucher. The procedures discussed in this section were followed for every follow-up study. The next section discusses more specifically the procedure for the 12-year follow-up study.

5.3 Procedure of the 12-year Follow-up

As part of the 12-year follow-up and as per general follow-up procedures, children and their families were seen within two weeks either side of their 12th birthday (corrected for the extent of prematurity). Figure 5.3 provides in order of completion, an overview of the tasks undertaken at the 12-year assessments. Those in bold text were measures relevant for this thesis and are described in the measures sections of the relevant results chapters.

5.3.1 Prior to the follow-up assessment. For the 12-year recruitment, each child's parent/guardian was contacted via letter and telephone and provided with a verbal explanation of the 12-year follow-up study. After consent of 'intention to participate' was given, an information package was sent to the children and parents/guardians. This included information for the assessment time and location as well as a questionnaire for the child to complete prior to the assessment. The questionnaire was made up of two parts: the Social Life Questionnaire and the School Life Questionnaire. The Social Life section was completed through an online questionnaire and the School Life section was completed in a paper booklet. This was done to reduce the duration of the follow-up visit at the research facility.

The Social Life online computer questionnaire was developed on the *Qualtrics* website by the author of this thesis. Parents were asked for their email address when they were contacted by phone about participating in the 12-year follow-up. They were sent an email containing a link to the online questionnaire. Parents were asked to give their children privacy while completing the task, but could help if the child requested. If conducted at the research facility, the child completed the questionnaire in a private room, and could ask the researchers for help at any time. On average, the whole computer questionnaire took approximately 20 minutes to complete. Children were shown how far through they were with a progress bar. Children could not complete a page and move to the next one if there were missing answers. The programme also did not allow for a question to be answered twice.

The School Life questionnaire was a paper and pencil questionnaire which the children completed. The questionnaire covered the children's experiences at school. This questionnaire took

approximately 10 minutes to complete. If these had not been completed on arrival at the research facility, they were finished during the follow-up assessment at the research facility.

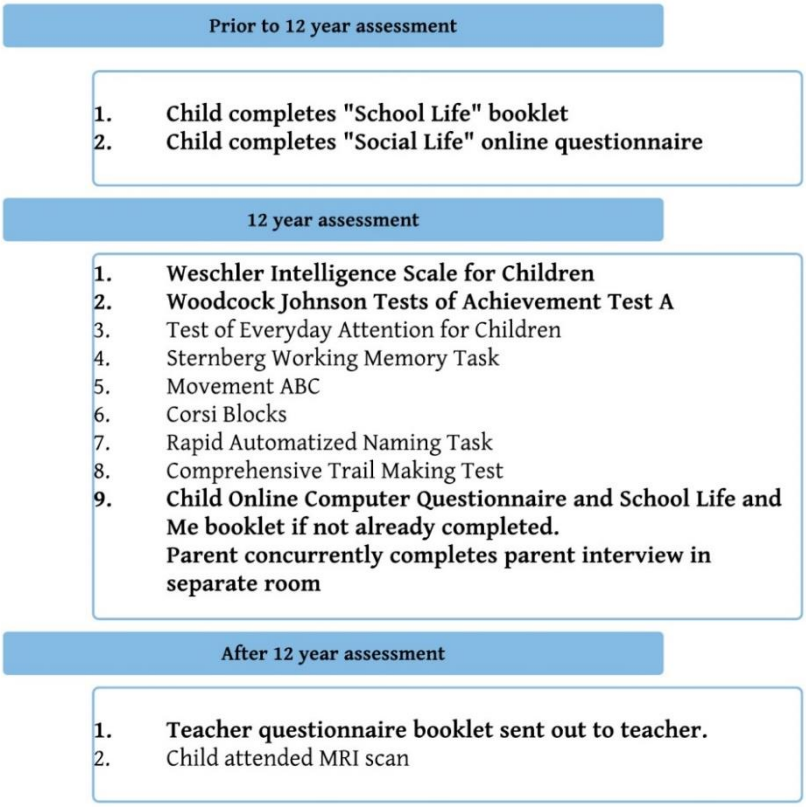

Figure 5.3: Overview of Tasks Completed at 12-year Assessment Displayed in Order of Completion. Bold Items Were Used in This Thesis.

5.3.2 The follow-up assessment. Twelve year follow-up assessments were on average four hours in duration. Domains included in the assessment were children's cognitive, social, emotional, and behavioural outcomes. In addition, further information about the children's development, health, education, current family situation and experiences in the last three years was obtained via a parent interview. Standard protocols for the administration of the tasks were followed at all times.

With permission of the principal investigator of the Canterbury Preterm Study and the Regional Ethics Committee (URA/10/05/040; See Appendix C), extra measures were included into the 12-year follow-up assessment to examine in detail the social competence outcomes at age 12 years. This meant that for some children (n = 24) a few measures examined in the 12-year follow up were collected subsequent to the child's 12-year developmental assessment. This was achieved by telephoning the parents and conducting home and/or school visits to complete the measures.

Secondly, at the 12-year follow up, due to disruptions from the 2011 Canterbury Earthquake(s), data collection was stopped for two months to allow for the traumatic, stressful and

accessibility effects of the earthquake to diminish. Subsequent to the recommencement of assessments, children were seen within ±4 weeks of their 12th birthday (corrected for the extent of prematurity). As a result of the Canterbury Earthquake(s) a number of participants had relocated to other cities or countries and travel compensation was given to those who travelled to return to Christchurch for the study. The earthquake and travel of participants resulted in a number of children (n = 56) that were unable to be seen within ±4 weeks of their birthday.

5.3.3 After the follow-up assessment. Subsequent to each assessment, a teacher questionnaire was posted to the child's teacher which drew out their perspective on the child's cognitive, social, emotional, educational and behavioural outcomes for the current school year. At age 12, the children also underwent an MRI brain scan (during a separate shorter visit to the Van Der Veer Institute) requiring a separate consent procedure. The 12-year MRI study was not used in this thesis and will not be discussed further.

5.3.4 Author's contribution. The author of this thesis conceptualised the thesis topic and the measures used to assess social competence in 12 year old children and incorporated them into the existing research procedure. The author of this thesis was a member of the 12-year follow-up assessment team where she was responsible for:

- Inviting families to participate and informing them on the process
- Preparation of the research facility and assessment tasks
- The administration and scoring of various neuropsychological tests (including the Wechsler Intelligence Scale for Children, 4th Edition; the Woodcock-Johnson Tests of Achievement, 3rd Edition as she had previous clinical psychology training) and several other cognitive tasks such as the Corsi Blocks and the Test of Everyday Attention for Children
- Administration and collection of the child interview and teacher questionnaire
- Writing some of the neuro-psychological reports for the participants
- Data entry, cleaning, analysis and interpretation

There were two other psychology doctoral students involved in their own independent research within the Canterbury Preterm Study and two research staff who also were responsible for administering and scoring various neurodevelopmental tasks with the children and conducting the parent interview.

5.4 Overview of Measures

As specified earlier, the two subsequent chapters will detail the specific measures used within the studies in this thesis. However, this section provides an overview of how the tri-component model of social competence was used to structure the measurement of social competence. Figure

5.4 presents each component of social competence and the subdomains that were measured within each component. The green boxes show which measures were used to measure each subdomain.

The social skills component had two sub-domains, interpersonal skills and socio-cognitive skills. Interpersonal skills were measured through a custom made teacher report questionnaire. Socio-cognitive skills were measured through two child-report questionnaires. Both parent and friend attachment was assessed using the Inventory of Parent and Peer Attachment – Revised (IPPA-R; Gullone & Robinson, 2005) and rejection sensitivity was measured using the Children's Rejection Sensitivity Questionnaire (CRSQ; Downey, Lebolt, Rincon, & Freitas, 1998).

The social performance component was comprised of three domains: prosocial behaviour; aggressive behaviour and frequency of interaction. Prosocial and aggressive behaviour was measured by parent and teacher report using the Prosocial subscale, and a bullying item from the SDQ (Goodman, 1997). Aggressive Behaviour was also measured using child report on a questionnaire adapted from the Multidimensional Peer Victimization Scale (MPVS; Mynard & Joseph, 2000). Frequency of interaction was assessed through parent and child report on custom made questions.

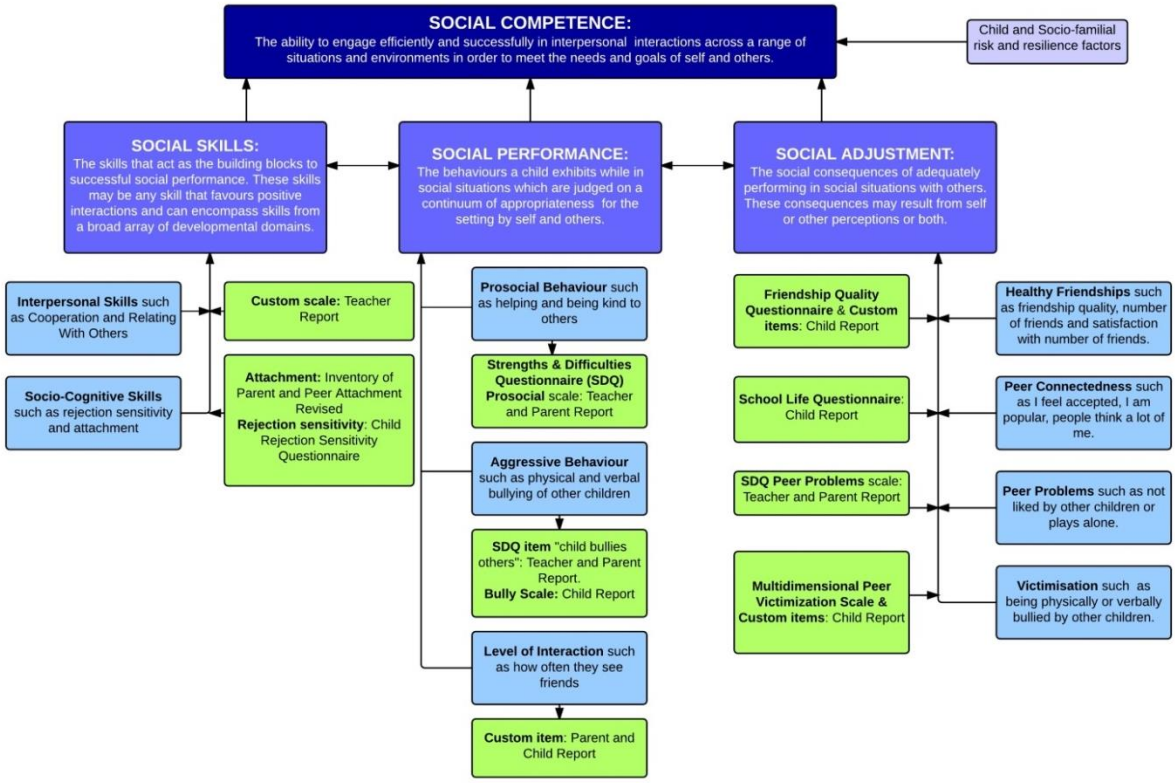

Figure 5.4: Overview of Measures Used to Examine Social Competence at Age 12 Years.

Social adjustment was comprised of four sub-domains. Details on the children's friendships was measured using child-report on custom made questions as well as the Friendship Quality Questionnaire (Parker & Asher, 1993a). How connected a child felt to their wider group of peers at school was measured using the Peer Connectedness Subscale from the School Life Questionnaire (Australian Council for Educational Research, 1984). Parents and teachers also reported on the child's peer relationships using the Peer Problems Subscale of the SDQ (Goodman, 1997). Finally, children reported the frequency and nature of victimization they received using the MPVS (Mynard & Joseph, 2000).

5.5 Data Management

Data was stored in locked file cabinets in a locked storage room at all times. Data was entered into a Microsoft Access Programme by PhD candidates as well as a hired data-entry statistician. Data entry was randomly cross-checked for errors. Data for use within this thesis was then cleaned by the current author.

Descriptive statistics were run in order to check for outliers and to examine the distribution of the data (see Appendix D for detailed information). Two outliers were identified and excluded from the data set. This included a child who reported that their best friend was 29 years old and a child who had answered the entire questionnaire incorrectly. The remaining outliers (n = 2) were 'real' outliers (one on rejection sensitivity and one on prosocial behaviour). To accommodate this data, the outliers' data were changed to be identical to the next data point in. This resulted in normal distributions without loss of data but reduced the impact of that data point on results (Tabachnick & Fidell, 2013).

Additionally, Kolmogorov-Smirnoff tests of normality indicated that most measures did not meet the assumption for normality. Levene's test of homogeneity also indicated that at times there were differences in the size of the variances between each gestational group. Appropriate alternate test corrections were used when variances were unequal. Skewness and kurtosis were at times high. Largely, non-normal distributions were a function of the nature of the phenomenon being measured and are commonly found in the literature (e.g. skewness of SDQ sub-scales is common). However, due to the large sample included in this thesis (n < 200) these non-normal distributions should not impact substantially on the results (Tabachnick & Fidell, 2013). Despite this, some continuous variables were dichotomised to indicate those with significant problems and those without. Secondly, all continuous data was also analysed using non-parametric tests (such as Kruskil-Wallis tests) to examine if the results remained significant when accounting for the violation of assumptions

of parametric tests. No results significantly differed between parametric and non-parametric analyses.

5.6 General Information on Data Analyses

Specific details on the analyses conducted in this thesis are outlined in the appropriate sections of Chapter Six, Seven and Eight. This section provides general information pertaining to all results chapters. All statistical analyses were run on Statistical Package for the Social Sciences (SPSS) Version 22. At times multiple statistical comparisons were conducted as a result of the number of outcome variables included in the thesis which can increase the rate of Type I error. The use of a correction, such as Bonferroni's correction, was considered however, in line with preterm literature, it was decided, to address the risk of Type I error by: 1) using multivariate analysis of variance[3] (MANOVA) tests (Field, 2013); 2) analysing data with a focus on statistical significance in combination with effect sizes (practical significance); 3) including both significant and non-significant results to provide transparency in the number of analyses conducted; 4) carefully examining each set of results to make sure the numbers made clinical sense and to identify any patterns occurring. Patterns add strength to the results and are less likely to be the result of spurious findings; and 5) acknowledging where findings are preliminary and that follow-up studies would need to replicate findings. An alpha significance criterion of $p < .05$ was used as a cut-off point of statistical significance for all analyses in line with Neyman and Pearson's theory of testing hypotheses (Tabachnick & Fidell, 2013).

As noted above, also of importance throughout this thesis is practical significance. Practical significance indicates that a statistical finding is useful or meaningful in real life and is measured by effect sizes. Effect sizes are fundamental to the interpretation of data (Cumming, 2013). It is an important measure of significance as large samples can produce statistically significant findings which are not practically significant. Therefore, this thesis will privilege effect sizes over statistical significance but will take both into account (Cumming, 2013). Effect sizes used in this thesis include correlation coefficients, Cohen's d, Partial Eta Squared (η_p^2) and odds ratios (OR's) which are briefly outlined here.

Correlation coefficients measure the degree of association between two variables (Yount, 2006). A coefficient close to 0 indicates no relationship between the two variables where as a relationship close to -1 or 1 indicates a strong systematic relationship between the two variables. More specifically, a correlation coefficient of .10 is considered a weak association; a correlation

[3] Outliers and multi-collinearity were checked and were not an issue for the completion of any of the MANOVA analyses.

coefficient of .30 is considered a moderate association; and a correlation coefficient of .50 or larger is considered a strong association (Cohen, 1988; Tabachnick & Fidell, 2013). These guidelines in combination with statistical significance ($p < .05$) will guide interpretation for rejecting the null hypothesis that in the population the true correlation is zero.

There is a family of effect sizes to choose from and were used in this thesis to interpret the strength of association of focused between-group comparisons. Pearson's correlation coefficient was used to measure the association between two interval or ratio variables, Spearman's rho correlation coefficient was used to compute the correlation between ordinal or ranked variables and was used with non-parametric data. Biserial correlations were used to compute the correlation between dichotomous and interval or ordinal variables and the Phi coefficient was used to assess the association between two dichotomous variables.

Cohen's *d* is another effect size which is used for pairwise comparisons such as t-tests. The value of Cohen's *d* describes the standardized mean difference of an effect in terms of standard deviation units (Pallant, 2013). A commonly accepted rule of interpretation, adopted in this thesis is that a small effect size is 0.2, a medium effect size is 0.5, and a large effect size is 0.8 (Cohen, 1988; Pallant, 2013).

Partial Eta Squared is another effect size which can be used for between-group analyses of more than two groups and is used to measure the strength of the association in ANOVA analyses (Tabachnick & Fidell, 2013). It measures the proportion of variance that a variable explains when excluding other variables in the analysis. These effect sizes can be interpreted as 0.01 considered small, 0.06 considered medium, and 0.14 considered large effects (Cohen, 1988; Pallant, 2013; Tabachnick & Fidell, 2013). These were used for ANOVA analyses and were then followed up by pairwise comparisons with Cohen's *d* effect sizes in order to determine the specific strength of these individual comparisons which were of interest (Field, 2013).

Finally, OR's were used to determine the strength of association for results with categorical variables such as Chi-Square analyses. The OR value represents the ratio of the odds of an event occurring in one group compared to another (Field, 2013). Phi was used to interpret the relationship between 2x2 contingency tables and Cramer's V was used to interpret the association between 3x2 contingency tables. Effect sizes for both Phi and Cramer's V were considered small if the value was 0.1, moderate if the value was 0.3 and strong if the value was 0.5.

All between-group differences using continuous variables were adjusted for confounding variables using analysis of covariance (ANCOVA). Binomial logistic regression was used to adjust for potential confounding variables in analyses with dichotomous variables where the dichotomous predictor was inserted as the dependent variable and birth status and the confounding variable were

entered as predictors. Confounding variables adjusted for in this thesis included SES and maternal education due to between-group differences existing on these background variables.

"It makes me quite sad, I play by myself now since everyone is into sport but I do go the music room at morning tea and lunchtime with a few friends that jam along to the beat."

- ***Male participant born EPT (24 weeks)***

Chapter Six

"I Play by Myself Now": Friendship and Peer Relationship Experiences of Preadolescent Children Born EPT and VPT[4]

Children born EPT and VPT are at an increased risk for a range of neurodevelopmental impairments, with these risks increasing with decreasing gestational age at birth (Saigal & Doyle, 2008; Woodward et al., 2009). These include cognitive and language delay, learning problems, attention-deficit/hyperactivity disorder (ADHD), and neuro-motor impairments (Pritchard, Bora, Austin, Levin, & Woodward, 2014; Saigal & Doyle, 2008; Woodward et al., 2012; Woodward et al., 2009). Another, less well studied, but important aspect of development is the formation of friendships and social relationships with peers. For school age children, making friends and being included in peer activities not only impact their immediate wellbeing and school achievement (Rueger & Jenkins, 2014; Wang et al., 2014) but also has a significant influence on their longer-term employment, mental health, and intimate relationship outcomes (La Greca & Harrison, 2005; Woodward & Fergusson, 1999, 2000). For example, a recent study using longitudinal data from two large prospective cohorts in the UK and USA found that child peer-victimization is associated with worse adverse mental health outcomes during adulthood compared with maltreatment by adults (Lereya, Copeland, Costello, & Wolke, 2015).

A recent systematic review of 23 cohort studies published from 1990 to 2014 showed that VPT born children experience more social competence difficulties than their term born peers (Ritchie, Bora, & Woodward, 2015). Specifically, they are at increased risk of peer relationship problems, social

[4] Adapted from ***"I Play by Myself Now": Friendship and Peer Relationship Experiences of Preadolescent Children Born Very Preterm***," by Ritchie, Bora and Woodward, currently under preparation for submission to *Pediatrics*.

withdrawal, and poor socio-emotional skills such as emotion regulation difficulties (Ritchie et al., 2015). These difficulties appear to emerge early and persist throughout childhood, with children born EPT being at greatest risk (Ritchie et al., 2015). Findings from a more recent study of two international cohorts have shown that VPT born children are also more likely to being bullied by their peers compared to FT children, which in turn was independently associated with emotional difficulties over and above the effects of prematurity (Wolke et al., 2015). However, from the systematic review it was also clear that existing studies are methodologically limited by reliance on cross-sectional data obtained from single informant, absence of peer or child self-report, and the lack of a guiding theoretical or conceptual model of social development (Ritchie et al., 2015). Almost all studies have used behaviour screening or summary measures of peer relations, precluding an understanding of the nature of children's friendships and peer experiences (Ritchie et al., 2015). Finally, few studies have been concerned with preadolescence, a critical period of development when peer relationships begin to emerge as one of the most critical contexts for learning about themselves and others (Bagwell, Newcomb, & Bukowski, 1998; Berndt, 1982).

Thus, the aim of the current study was to describe the nature of VPT born children's friendships, peer relationships, and peer-victimization experiences relative to their FT peers at age 12 years. *Friendships* refer to relationships that involve emotional closeness and spending time together. *Peer relationships* refers to the peers at school that the children may interact with on a daily basis but do not have a close emotional bonding. Given previous evidence to suggest that EPT born children may be at increased risk, the VPT cohort was stratified into two groups: those born VPT or EPT. It was hypothesized that children born VPT and particularly EPT born children would have fewer friends, poorer quality friendships, more negative peer interactions, higher rates of peer problems, and be subject to higher rates of victimization relative to their FT peers. Finally, this study examined the child and family characteristics (such as concurrent academic ability, behavioural and emotional difficulties, physical development, and SES) of the children who presented with peer relationship difficulties and frequent peer victimization experiences.

6.1 Methods

6.1.1 Sample. The sample included a regional cohort of 44 EPT born children, 60 VPT born children, and 109 FT born children. The sample selection process and the sample characteristics have been described previously (pages 52 - 56, Chapter Five).

6.1.2 Procedure. The procedure has also been described previously (pages 56 - 60, Chapter Five).

6.1.3 Assessment: Measures and informants. Alongside previous research and theory relating to preadolescence, the tri-component model of social competence was used as a theoretical framework for the selection of study measures (Cavell, 1990). This paper is primarily concerned with the social adjustment aspect of the tri-component model, defined as the ability to attain developmentally appropriate social goals such as establishing and maintaining quality friendships, engaging harmoniously with peers, and not being a target of frequent peer-victimization. All aspects of social adjustment were assessed at age 12 years. Table 6.1 summarizes the specific social adjustment aspects assessed in the current study and whether child, parent and/or teacher reported on each one.

Table 6.1: Areas of Social Adjustment Measured at Age 12 Years in The Current Study, and The Informant who Reported on Outcome.

Measure	Child	Parent	Teacher
Number of Friends	X	X	
Age and duration of best friendship	X		
Friendship Quality	X		
Social Interaction	X	X	
Peer Connectedness	X		
Peer Problems		X	X
Frequency and Type of Victimization	X		

Friendship quantity and quality.

Friendship quantity. Children and parents were asked whether the study child had 'No', '1−2', '3−4', or 'Several/Many' friends. Child and parent report were kept as separate variables and for both informant's reports, children who were reported to have '1-2' or '3-4' friends were subsumed into one category so both child and parent report variables each had three groups, namely 'No friends', '1-4 friends' and 'Many friends'. Furthermore, children were asked if they were satisfied with the number of friends that they had. They could respond: 'Yes' or 'Not Sure' or No'. 'Not sure' and 'no' answers were combined. Children were also asked how old their best friend was in years and how long they had been friends for out of 'Less than a few months', 'Less than a year', 'More than a year', or 'More than 3 years'. Due to low frequencies, children responding that their friendship was less than a few months, or less than a year were combined.

Friendship quality. The Friendship Quality Questionnaire (FQQ), a 40-item questionnaire assessed each child's self-perceptions of the qualitative features of their best friendship, such as how

much intimate exchange occurred between them and how much they take care of each other (Parker & Asher, 1993b). All children were asked to complete this section on a child they considered their best friend. Children who reported not having any friends were still asked to complete this questionnaire with the closest peer in mind and all children were able to do so[5]. Items were rated on a 5-point Likert scale ranging from 'Not At All' to 'Really True' and summed to form six subscales and a total friendship quality score. Subscales included: 1) Validation and Caring, 10-items; 2) Intimate Exchange, 6-items; 3) Companionship and Recreation, 5-items; 4) Help and Guidance, 9-items; 5) Conflict Resolution, 3-items; and 6) Conflict and Betrayal, 7-items. The FQQ has strong psychometric properties with internal reliability (Cronbach alpha) of subscales ranging from .73 to .90 and correlating well with children's friendship satisfaction and feelings of loneliness (Parker & Asher, 1993b). The internal reliability (Cronbach alpha) of the subscales for this sample ranged from .62 to .89. Finally, to assess the extent of the child's social interactions, children and their parents were questioned about how often they saw their best friends. They could respond: 'Never'; '1−2 times per week'; '3−4 times per week;' or 'Always'. Child and parent report were kept as separate variables and for both informant's reports, children who were reported to see their friends '1-2' or'3-4' times per week were subsumed into one category so both child and parent report variables each had three groups, namely 'Never', '1-4 times' and 'Always'.

Peer relationships.

Peer connectedness. Inclusion and acceptance by school peers was measured using custom written items from a 9-item Social Integration scale from the School Life Questionnaire (Australian Council for Educational Research, 1984). Examples of items include "*at school people think a lot of me*" and "*at school I get along with others*". Children recorded their responses using a 4-point Likert scale ranging from 'Disagree' to 'Agree'. Psychometric properties were not available for the measure, however, Cronbach alpha for this subscale in the current study was 0.88. This measure was moderately correlated with the frequency of victimization reported by the children (correlation coefficients = -.39).

Peer problems. The extent of each child's peer relationship problems was assessed using the parent and teacher rated Peer Problems subscale of the SDQ (Goodman, 1997). This scale consists of 5-items rated on a 3-point Likert scale based on the child's behaviour over the last 6 months, with higher scores indicating more peer problems (Goodman, 1997). The SDQ is one of the most widely used behaviour screening measures in epidemiological research and clinical practice and has been consistently shown to have excellent concurrent and predictive validity (Goodman, 1997, 2001). It has also been recommended

[5] Analyses were run with and without these children included and there were no statistically or practically significant changes.

for use in New Zealand (Harvey, Barry, Fitzgerald, Evans, & Bennett; Merry et al., 2004). Cronbach alpha's for the parent and teacher report for this subscale in the current study was .67 and .73, respectively.

Victimization. Children were asked questions about peer-victimization in three stages. First, they were questioned about the extent to which peers had victimized them in the past six months. They could choose from 'Not at All', 'Once or Twice', '2−3 times per month', 'Weekly', or 'Several times per week'. For the purposes of the current study two dichotomous variables were created. Firstly, children who reported experiencing 'any victimization' from peers were classified as having experienced victimization (and were scored a '1'), as opposed to those who reported no peer victimization (who were scored a '0'). The second dichotomous variable was created by classifying children who reported experiencing 'frequent victimization'. If they reported being victimized by their peers 'several times per week' they were scored a '1' and if they reported 'weekly' or less frequent victimization they were scored a '0'. Second, the nature of victimization was assessed using the 16-item Multidimensional Peer Victimization Scale (MPVS; Mynard & Joseph, 2000). The MPVS includes four subscales assessing physical, verbal, social manipulation, and property attacks. Responses were recorded on the same 5-point scale as above: 'Not at All', 'Once or Twice', '2−3 times per month', 'Weekly', or 'Several times per week'. The internal reliability of each subscale is satisfactory (Cronbach alpha: .73−.85; Mynard & Joseph, 2000). The internal reliability of each subscale for this sample was also satisfactory (Cronbach alpha: .72−.81). For the purposes of the current study, dichotomous variables were also created for the physical, verbal, property and social manipulation variables if a child reported that they had experienced any of that type of victimization. Children then rated the extent to which peer-victimizations made them feel upset. Responses were recorded using a 5-point scale ranging from 'Not At All' to 'Extremely Upset'. Finally, children also reported if they had told anyone about their victimization and bullying experiences.

Associated risk factors used in the regression analyses. *A priori* theoretical knowledge and correlation coefficients were used to determine the variables included in the regression analysis. Three distinct areas were hypothesized to influence the children's social adjustment outcomes. These were baseline and family characteristics, 12-year physical outcomes, and 12-year socio-emotional and cognitive outcomes. The variables that were entered into the regression analyses are described below.

Baseline and family characteristics.

Socio-Economic Status. SES was measured by Elley-Irving scale (Elley & Irving, 2003). This measure ranks family SES by the highest occupation held by either of the parents in the family. The measure classifies occupations between '1' (highest level, Professional) and '6' (lowest level,

Unemployed, which included housewives and students). Highest family SES was recorded at age 2 as a continuous variable. This measure has adequate concurrent validity with other measures of SES such as paternal and maternal education, home ownership, family finances, ratings of living standards and quality of accommodation (Fergusson & Horwood, 1979).

Maternal age. Maternal age at child birth was recorded as a continuous variable.

12-year physical characteristics.

Body mass index. At the 12-year follow up assessment, the children had their height and weight measured and a Body Mass Index (BMI) calculated (weight in kilograms divided by the square of height in metres). The BMI scores were then dichotomised to indicate those children with a BMI above the 90th percentile of the FT children.

Pubertal development. Secondly, children were asked to rate their level of pubertal development of the Tanner Pubertal Development Scales (Marshall & Tanner, 1969, Marshall & Tanner, 1970). These two scales pictorially display five levels of each sex's genital and pubic hair development with higher levels representing more pubertal development. Children were asked to indicate which stage on each chart represented their physical genital and pubic hair development. The children's responses on the genital subscale were used in the current study as an indicator of pubertal development because the two scales were highly correlated (.94).

Vision and hearing problem and health concern. Finally, parents and teachers were asked if the child had a vision or hearing problem. They could respond 'yes' or 'no'. If either informant reported that the child had a sensory issue, the child was scored a '1' if no informant reported a sensory issue the child was scored a '0'. Parents also reported if their child had a health concern. They could respond 'yes' or 'no'.

Motor ability. The child's motor ability at age 12 years was assessed using the Movement Assessment Battery for Children-Second Edition (MABC-2). This assessment tool provides quantitative and qualitative measures of fine and gross motor ability. There are three subscales which include: 1) Manual Dexterity, 2) Aiming and Catching and 3) Balance. However, a total motor movement competence score was computed to define the degree of motor impairment. Lower scores represented a higher impairment of motor ability. The Movement ABC-2 is a widely used standardized measure of child motor difficulties (Henderson, Sudgen, Barnett, & Petermann, 1997; Henderson, Sugden, & Barnett, 2007).

Cerebral palsy classification. The presence and severity of Cerebral Palsy in all children was assessed at the 9 year follow-up using the Gross Motor Function Classification System for Cerebral Palsy (Palisano & Galuppi, 1999). It can be used for children from less than age 2 years to 12 years. Experienced paediatricians used this measure to rate each child on their abilities to conduct certain movements independently. A five point scale is used in this measure with higher levels representing more motor impairment and dependency on others for the execution of motor tasks. It has been shown to have high inter-rater reliability (0.93), test-retest reliability (0.79) and predictive validity (Wood & Rosenbaum, 2000).

12-year socio-emotional and cognitive characteristics.

Emotional problems and hyperactivity/inattention difficulties. The extent of the child's emotional problems and hyperactive/inattentive behaviour was assessed using the parent and teacher rated Emotional Problems and Hyperactivity/Inattention subscales of the SDQ (Goodman, 1997). Both subscales consist of 5-items rated on a 3-point Likert scale based on the child's behaviour over the last 6 months, with higher scores indicating more problems. Parent and teacher report were summed together for these two outcomes, as the combined report of the two informants is considered to be more reliable (Johnson, Hollis, Marlow, Simms, & Wolke, 2014; Treyvaud, 2014).

Academic achievement. The child's level of academic achievement was assessed using the Woodcock-Johnson III, Test-Revised Tests of Achievement (Woodcock, McGrew, & Mather, 2001). This set of tasks assesses reading, mathematics, and writing, in children and adults aged 2 to 96 years (Woodcock et al., 2001). Eight subtests on this measure were completed by all children. Four assessed their reading ability (Reading Fluency, Letter-Word Identification, Passage Comprehension and Word Attack) and four assessed their mathematical ability (Calculation, Math Fluency, Applied Problems and Quantitative Concepts). This test battery is widely used in developmental literature and has strong psychometric properties (McGrew & Woodcock, 2001).

All subtests final scores were all highly correlated within the current study. The *Maths Fluency* subtest was the most strongly associated with the social adjustment outcomes (see Table E.1, Appendix E) and therefore was used in this chapter while the rest were eliminated to avoid multi-collinearity. For the Math Fluency subtest, children were asked to solve addition, subtraction, and multiplication problems as quickly as they could using pen and paper. Children were given three minutes to complete the problems or get as far through them as they could. The total score is the sum

of correctly completed items. Test-retest reliability for this subscale is >.90 (McGrew & Woodcock, 2001).

6.1.4 Data analysis. Data analysis was conducted in three stages. First, between-group differences in children's friendships, peer relations, and victimization experiences were examined using the one-way analysis of variance (ANOVA) for continuous variables. All analyses were followed by post-hoc comparisons using Gabriel's procedure. Gabriel's procedure controls for Type I family-wise error and is recommended when group sample sizes are unequal (Field, 2013). In some cases, however, variances between groups were unequal as well. In those cases post-hoc comparisons were checked with the Games-Howell procedure (as recommended by Field, 2013). Pearson's Chi-square test or Fisher's exact test were used for categorical variables. OR's and 95% Confidence Interval's (CI) were calculated for measures of strength of association.

Second, a set of potential child and family factors associated with children's friendships, peer relationships, and victimization experiences were identified using *a priori* information and bivariate correlations for various outcome measures. Variables that were demonstrated to have a statistically and practically significant association (>.30) and were subsequently included in the regression model. Associations were assessed to make sure there were no variables entered into the same block that were highly correlated (>.50) to avoid problems with multi-collinearity and singularity.

Finally, binary logistic regression modelling was used to determine the risk factors for children's increased risk of peer relationship difficulties and frequent victimizations. Due to the low sample size of EPT born children, all three groups were pooled and birth status was entered as one categorical predictor into the regression model where EPT birth status = 1, VPT birth status = 2 and FT birth status = 3. Within the regression, EPT and VPT groups were then compared against the FT group which was the reference category. Results are displayed for each comparison (EPT vs FT and VPT vs FT) in separate rows of result tables. Variables were entered into the regression equation in 3 distinct stages namely, Block 1) baseline and family characteristics, Block 2) 12-year physical characteristics, and Block 3) 12-year socio-emotional and cognitive characteristics. Model fitting was performed using both forwards and backwards variable selection to identify the most parsimonious model, with a $p < .05$ criterion used to retain variables.

While the current study sought to investigate specific factors associated with the quantity and quality of a child's friendships, regression modelling was not feasible due to low rates of children with no friends or poor quality friendships. Furthermore, an item in the SDQ Peer Problems scale (which constitutes our composite measure of peer relationship difficulties) examined whether the child had "at

least one good friend", so at least, in part, captured those with friendship difficulties too. Children were classified as having peer relationship difficulties if they were in the lowest 10% of children scoring on either of the peer connectedness or peer problem scales. Frequent victimization was defined as being victimized several times a week.

6.2 Results

6.2.1 Quantity and characteristics of friendships. As shown in Table 6.2, based on parent as well as child self-report, the majority of children in each study group had some (one to four) friends. However, having no friends was more common for EPT than VPT and FT born children and conversely having many (five or more) friends was more common for VPT and FT than EPT born children. These between-group differences were not statistically significant according to children (p = .14) but were according to parents (p < .001). Follow-up pairwise comparisons showed that according to parents, EPT had fewer friends than VPT and FT born children (both p <.001). Specifically, 14% of children in the EPT group were reported by parents to have no friends whereas having no friends was rare or non-existent for VPT and FT born children [X^2 (1, n = 104) = 8.68, p = .005, Phi = -0.29; and X^2(1, n = 153) = 11.62, p = .002, Phi = -0.28, respectively[6]]. Additionally, only 1 in 10 EPT born children were reported to have many friends compared with approximately 1 in 3 children in both the VPT (OR = 3.62, 95% CI = 1.23, 10.63, p = .02) and FT groups (OR = 4.01, 95% CI = 1.46, 11.03, p = .005).

Consistent with this, although the majority of children in each gestational group were satisfied with their number of friends, there was a statistically significant between-group difference in the proportion of those not satisfied with their quantity of friends (p = .001). Sixteen percent of EPT relative to only 1−2% of VPT and FT born children reported that they were not satisfied with the number of friends they had (p = .02 and .001, respectively). Follow-up post-hoc analyses showed that EPT born children were at 11 and 20 times the odds of not being satisfied with their quantity of friends compared to the VPT and FT born groups, respectively (OR = 11.11, 95% CI = 1.25, 100.00 and OR = 20.00, 95% CI = 2.38, 166.67, respectively). However, the lack of imprecision should be noted for the CI's of the satisfaction measure which likely resulted from a low base rate in the VPT and FT born groups.

[6] Odds ratios could not be calculated as no VPT born children were reported to have 'no friends'.

Table 6.2: Quantity, Nature and Quality of Extremely Preterm, Very Preterm and Full-Term Children's Friendships at Age 12 years.

Domain	EPT (*n*=44)	VPT (*n*=60)	FT (*n*=109)	Overall*	*p-values* EPT vs VPT	EPT vs FT	VPT vs FT
Quantity of Friends							
Child Report							
No friends, %	4.5	1.8	2.8				
Some (1-4) friends, %	70.5	50.9	53.8				
Many (5+) friends, %	25.0	47.4	43.4	.14	.07	.08	.90
Parent Report							
No friends, %	13.6	0.0	0.9				
Some (1-4) friends, %	75.0	68.3	65.1				
Many (5+) friends, %	11.4	31.7	33.9	<.001	<.001	<.001	.91
Child Reported Friendship Satisfaction							
Not satisfied, %	15.9	1.8	0.9	.001	.02	.001	1.0
Friendship Characteristics							
Duration of Best Friendship							
Less than a year, %	14.0	16.7	10.2				
One to three years, %	30.2	23.3	25.9				
More than three years, %	55.8	60.0	63.9	.72	.76	.67	.53
Age of Best Friend, M (Range^)	12.1 (7-15^)	12.1 (10-14)	11.9 (10-14)	.23	.96	.33	.12
Frequency of Friendship Contact							
Child Report							
Never Sees Best Friend, %	16.3	5.0	8.3				
1-4 times per week, %	30.2	41.7	28.7				
Always sees Best friend, %	53.5	53.3	63.0	.16	.13	.28	.21
Parent Report							
Never See Any Friends, %	22.7	8.3	6.4				
1-4 times per week, %	72.7	85.0	84.4				
Always sees friends, %	4.5	6.7	9.2	.07	.13	.02	.80
Quality of Best Friendship							
Child Report, *M(SD)*							
Friendship Quality Total	18.1 (3.3)	17.3 (3.8)	17.5 (3.9)	.53	.25	1.0	1.0

Notes: EPT: Extremely Preterm; VPT: Very Preterm; FT: Full-Term; * ANOVA p-value from comparison between all three gestational groups. %: Percentage of children with significant difficulties; M: Mean; SD: Standard Deviation; ^ Data excluded for one EPT child who had a best friend aged 29 years.

Further examination of the characteristics of the children's friendships showed that most of their best friendships had lasted for more than three years with few children in all groups reporting a best friendship of less than one-year duration (p = .72). On average the children's best friends were typically of a similar age across the study groups (p = .23). However, there was more variability in the ages of best friends for those in the EPT than the VPT or FT groups suggesting that EPT born children may have more non-conventional friendships. In terms of frequency of interactions with friends, between-group differences did not reach statistical significance for child or parent report (p = .16 and .07, respectively).

Although the overall difference was not significant, there was a statistically significant difference between the EPT and FT born children suggesting that EPT born children saw their friends less frequently than FT born children (p = .02). Specifically, almost 25% of EPT born children were rated by their parents as never spending time with their friends compared with only 8% of the VPT born children (OR = 3.23, 95% CI = 1.02, 10.00, p = .05) and 6% of the FT born children (OR = 4.35, 95% CI = 1.52, 12.50, p = .005). There were no statistically significant differences between VPT and FT born children on any of the above friendship measures. All statistically significant differences remained after adjustment for SES and maternal education ($p < .05$).

6.2.2 Friendship quality. Table 6.2 describes the friendship quality of the children's best friendships. Across all gestational groups children reported similar levels of friendship quality (p = .53). The highest quality aspects of friendships for all three groups were 'Validation and Caring' and 'Companionship and Recreation' (based on highest subscale scores; data not shown). These findings suggest that the strengths of children's friendships during preadolescent years involve caring for each other, spending fun time together, and making each other feel special. These are important aspects of friendships, which the EPT born children who have no friends or spend no time with friends may be missing out on.

6.2.3 Peer relationships and victimization. Table 6.3 describes the nature of the peer relationships of the study groups. Although there was no between-group difference in child reported peer connectedness (p = .14), almost one in four EPT born children reported low feelings of acceptance with their school peers compared with approximately 1−2 in 10 of their VPT (OR = 1.47, 95% CI = 0.55, 4.2, p = .46) and FT counterparts (OR = 2.50, 95% CI = 0.98, 6.25, p = .07). The OR was of a moderate effect size between the EPT and FT born groups with EPT born children being at 2.5 times the odds of reporting low peer connectedness than FT born children. Furthermore, there were between-group differences in the proportions of children in each gestational group with peer problems according to both parent and teacher report. More specifically, parents and teachers rated 32−37% of EPT born children to have significant peer problems as opposed to only 3−9% of VPT and FT born children (all p's < .005). According to parent and teacher report, EPT children had four to six times the odds of having peer problems than VPT and FT born children (OR = 4.55, 95% CI = 1.85, 11.11; and OR = 6.25, 95% CI = 2.56, 16.67, respectively). This suggests that EPT born children not only have more difficulties with friendships but they also experience greater difficulty connecting with their wider peer group compared with VPT and FT born children. All statistically significant between-groups differences remained statistically significant after adjustment for SES and maternal education.

Table 6.3: Extremely Preterm, Very Preterm and Full-Term Children's Peer Relationship Profiles at Age 12 years.

Domain	EPT (*n*=44) %	VPT (*n*=60) %	FT (*n*=109) %	*p-values* Overall*	EPT vs VPT	EPT vs FT	VPT vs FT
Peer Connectedness							
Child report	23.8	17.5	11.2	.14	.46	.07	.37
Peer Problems							
Parent Report SDQ	31.8	8.3	9.2	.001	.005	.001	1.0
Teacher Report SDQ	37.2	3.4	8.4	<.001	<.001	<.001	.33
Frequency of Victimisation							
Child Report							
Any victimization	61.9	40.7	52.8	.10	.06	.41	.18
Frequent Victimization	14.3	11.9	3.7	.04	.96	.03	.05
Type of Victimisation							
Any Physical	38.1	32.2	26.9	.39	.69	.25	.58
Any Verbal	61.9	49.2	53.7	.47	.29	.47	.69
Any Property	40.5	28.8	33.3	.48	.31	.53	.67
Any Social Manipulation	50.0	28.8	48.1	.03	.05	.98	.02
Extremely upset	9.3	3.3	1.8	.09	.23	.05	.62
Told someone	75.0	85.2	82.3	.63	.54	.61	.98

Note: EPT: Extremely Preterm; VPT: Very Preterm; FT: Full-Term; %: Percentage of children with significant difficulties; * ANOVA *p*-value from comparison between all three gestational groups

In terms of peer-victimization, irrespective of gestational grouping, similar proportions of children (around half) reported having been victimized at least once in the last 6 months ($p < .10$). However, 14% of EPT and 12% of VPT born children reported frequent (several times per week) victimization, compared with only 4% of FT born children ($p = .04$). Post-hoc analyses revealed that EPT born children had 4 times higher odds of being frequently victimized compared to term born peers (OR = 4.35, 95% CI = 1.16, 16.67, $p = .03$) and VPT born children had 3 times higher odds of being frequently victimized compared to term born peers (OR = 3.45, 95% CI = 0.98, 12.50, $p = .05$). However, after adjustment for SES, these between-group differences were no longer significant ($p = .09$ and $p = .17$ respectively). After adjustment for maternal education the between-group difference between EPT and FT born children remained statistically significant ($p = .03$) but not the between-group difference between VPT and FT born children ($p = .06$).

Further examination of the types of victimization experienced showed similar rates of verbal, physical, and property attacks for all three groups. There was a between-group difference seen for the social manipulation victimization ($p = .03$) with post-hoc analyses showing VPT born children to have two times lower odds of experiencing social manipulation in comparison to EPT (OR = 2.44, 95% CI = 0.18, 0.93, $p = .05$) and FT born children (OR = 2.29, 95% CI = 1.16 – 4.52, $p = .02$). Although this should be viewed cautiously due to the number of statistical comparisons conducted and the lack of a

pattern of findings within these results. Furthermore, the effect sizes were small (both Phi = 0.2) for the post-hoc comparisons. Therefore these results may be spurious findings and thus require confirmation. For all three groups verbal bullying was the most common type of victimization they had experienced. Of interest for this high-risk population, more EPT born children reported being made fun of because of their appearance compared to FT born children and this was clinically relevant (43% vs. 20%, OR = 2.94, 95% CI = 1.35, 6.25, p = .007). Rates were also high (31%) amongst VPT born children but this difference did not reach statistical significance relative to the FT group (p = .20). Of those that were victimized, higher rates of EPT born children (9%) reported being extremely upset than FT born children (2%, p = .05). Similar rates of children in each study group told someone about their victimization experiences (p = .63).

Overall, 1 in 3 EPT born children were identified as having no friends, peer problems, and/or frequent victimization compared with only 1 in 10 VPT and FT born children [32% vs. 9−12 %, X^2 (2, n = 209) = 12.91, p = .003, Cramer's V = .25). All between-group differences remained significant after adjustment for SES and maternal education.

6.2.4 Associated child and family factors. Supplementary Table E.1 (Appendix E) shows the bivariate correlations between a range of child and family variables and children's friendship, peer relationship, and victimization experiences. Based on *a priori* information and statistical significance and strength of the correlation coefficients, risk factors associated with two outcome variables (peer relationship difficulties and frequent victimization) were identified.

Peer relationship problems: Variables significantly correlated with peer relationship difficulties (p < .05 and correlation coefficient >.30) included birth status, vision difficulties, hearing difficulties, health concern, cerebral palsy classification, motor ability, hyperactivity/inattention, emotional difficulties, conduct problems, prosocial behaviour, child IQ, and WJ math fluency score. To avoid issues with multi-collinearity, conduct problems, prosocial behaviour and child IQ were not included in the model. Variables included in the peer relationship difficulties regression based on *a priori* information included family SES, sex, and participation in team sport. Therefore, family and baseline variables chosen to be regressed onto the peer relationship difficulties variable were entered in the following three respective blocks. Block 1 consisted of the baseline characteristics: birth status, sex, family SES. Block 2 consisted of child physical characteristics and included total motor score, health concern, visual difficulty, hearing difficulty, cerebral palsy classification; and Block 3 included the child socio-emotional and cognitive characteristics of math fluency score, hyperactivity/inattention, emotional difficulties and participation in team sport.

Table 6.4: Final Fitted Regression Models Associated with Social Adjustment Variables at Age 12 Years.

Measure	Block 1 Baseline Characteristics at Birth			Block 2 12-year Physical Characteristics			Block 3 12-year Socio-Emotional and Cognitive Characteristics		
	B (SE)	***Exp(B)***	***p***	**B (SE)**	***Exp(B)***	***p***	**B (SE)**	***Exp(B)***	***p***
Peer Relationship Problem									
EPT Birth Status	1.32 (0.40)	3.70	<.001	-	-	-	0.60 (0.47)	1.83	.20
VPT Birth Status	-0.01 (0.40)	1.00	.99	-	-	-	-0.55 (0.47)	0.58	.24
Math Fluency							-0.03 (0.01)	0.97	.01
Hyperactivity/Inattention*							0.15 (0.05)	1.16	.003
Emotional Difficulties*							0.16 (0.07)	1.17	.02
Frequent Victimization									
EPT Birth Status	1.67 (0.75)	5.29	.03	1.42 (.81)	4.12	.08	0.89 (0.85)	2.44	.29
VPT Birth Status	1.47 (0.72)	4.36	.04	1.33 (.78)	3.77	.09	1.15(0.81)	3.15	.15
Maternal Age	-0.14 (0.05)	0.87	.007	-0.17 (.06)	0.84	.003	-0.17 (0.06)	0.85	.008
High Body Mass Index				1.92 (0.87)	6.26	.004	2.21 (0.90)	9.12	.01
Puberty Development				-0.92(0.41)	0.40	.03	-1.06 (0.47)	0.35	.02
Vision Problem				1.83 (0.64)	6.26	.004	1.88 (0.68)	6.53	.006
Hyperactivity/Inattention*							0.20 (0.08)	1.23	.008

Note: B: Standardised Beta; SE: Standard Error; Exp (B): Odds Ratio; EPT: Extremely Preterm group compared to FT group as reference category; VPT: Very Preterm group compared to FT group as reference category. *combined mean of parent and teacher SDQ scores.

Variables that made an independent net contribution to the prediction of peer relationship problems are shown in Table 6.4. Results showed that lower math fluency scores, higher hyperactivity/inattention and emotional difficulties scores were associated with having peer relationship difficulties at age 12 years. Specifically, every unit score higher on the math fluency test resulted in 1.03 times lower odds of having peer problems at age 12 years (OR = 0.97, 95% CI = 0.95, 0.99, p = .01). Additionally, every unit score higher on the hyperactivity/inattention or the emotional difficulties subscale of the SDQ resulted in a 1.2 times higher odds of having peer problems at age 12 years (OR = 1.16, 95% CI = 1.05, 1.28, p = .003; OR = 1.17, 95% CI = 1.03, 1.34, p = .02). None of the 12-year physical characteristics were of practical or statistical significance. This final model was statistically significant $X^2(5, n = 201) = 53.41$, $p < .001$, and explained between 23% (Cox and Snell R^2) to 34% (Nagelkerke R^2) of the variance in the children's risk of peer relationship difficulties at age 12 years. This model explained away the effect of birth status on the social adjustment outcome of peer problems: (EPT p = .20, VPT p = .24).

Victimization: No variables were moderately correlated with frequent victimization. Therefore, all variables included in the frequent victimization regression were based on *a priori* information. Family and baseline variables (Block 1) chosen to be regressed onto the frequent victimization variable were birth status, sex, family SES, maternal age at childbirth; child physical characteristics (Block 2) included visual difficulty, high BMI, low BMI, pubertal genital development, total motor score; and child socio-emotional and behavioural characteristics (Block 3) included math fluency score, hyperactivity/inattention, and emotional difficulties.

Variables that made an independent net contribution to the prediction of victimization are also shown in Table 6.4. Younger maternal age, higher body mass index, less pubertal development, vision problems and higher inattention/hyperactivity scores were associated with being frequently bullied at age 12 years (see Table 6.4). For every year older the child's mother was at childbirth, the odds of having peer problems at age 12 years was 1.2 times lower (OR = 0.85, 95% CI = 0.75, 0.96, p = .008). Children who had a high BMI were at nine times the odds of being bullied than those with a normal or low BMI, although the imprecision of the estimates suggested by the CI's should be taken into account (OR = 9.12, 95% CI = 1.56, 53.31, p = .01). Every score higher on the pubertal development scale put children at almost three times lower odds of being victimized compared to those with less pubertal development (OR = 0.35, 95% CI = 0.14, 0.87, p = .02). Additionally, those with vision problems had six times the odds of being victimized than those without vision problems (OR = 6.53, 95% CI = 1.73, 24.64, p = .006). Finally, every unit score higher on the hyperactivity/inattention scales of the SDQ resulted in a 1.2 times higher odds of having peer problems at age 12 years (OR = 1.23, 95% CI = 1.05, 1.43, p = .008). The final model was statistically

significant $X^2(7, n = 202) = 38.21, p < .001$, and explained 17% (Cox and Snell R^2) to 41% (Nagelkerke R^2) of the variance in the children's risk of being bullied frequently. This model explained away the effect of birth status on the social adjustment outcome of victimization: (EPT $p = .29$; VPT $p = .15$).

6.3 Discussion

The current study aimed to examine whether preterm born children are at an elevated risk of poorer social adjustment outcomes compared with FT born children at age 12 years. Of particular interest was to profile the characteristics of friendship and peer relationship experiences of preadolescents who were born EPT or VPT. Methodological strengths of the study included: the unselected nature of the contemporary, regional cohort of preterm sample; high rates of sample recruitment and retention; inclusion of a demographically representative FT born comparison group; and the use of multiple informants, including child self-report to assess social outcomes.

Results showed that relatively higher proportions of children in the EPT group did not have friends, wanted to have more friends, and had less frequent social interactions with friends than the children in the FT group. Although there were no differences in friendship quality or duration of friendship between EPT and FT born children, due to a lack of friends or lack of contact with friends, a larger proportion of EPT born children are likely to be missing out on crucial social-emotional experiences during the critical preadolescent years that may impact their later outcomes (Bagwell et al., 1998; Berndt, 1982). For example, results showed that the strongest aspects of friendship during preadolescence were spending time together, having fun, and making each other feel special and cared for. However, having no or fewer friends and less frequent interactions will provide fewer opportunities to learn and practice valuable social skills pertinent for the formation of intimate relationships and optimal social, emotional and occupational functioning during adolescence and early adulthood (La Greca & Harrison, 2005; Woodward & Fergusson, 1999, 2000). This may then negatively impact their ability to obtain friends at later stages of life, which can lead to more social ostracism and further deterioration of their social and emotional outcomes (Carr, 2006; Jose et al., 2012).

Somewhat reassuring when considering the actual quality of children's best friendships was the finding that EPT or VPT born children do not have diminished friendship quality compared with FT born children. The duration of their best friendships and age of best friend were similar suggesting that they can also maintain these friendships with same-aged peers. Thus, it is clear that when given the opportunity to make friends, preterm children are able to develop lasting and quality friendships; with only a small subset of EPT born children experiencing friendship difficulties.

Therefore, strategies aimed at expanding the opportunities for these children to develop friendships could be a valuable intervention.

In terms of peer relationships in the wider school context, EPT but not VPT born children were found to have significant difficulties relating with their peers, and both EPT and VPT born children were at an increased risk of frequent peer-victimizations compared with FT born children. While previous studies have reported VPT born children to be at risk of victimization (Grindvik et al., 2009; Wolke et al., 2015), they have also found these children to be at high-risk of peer problems (Ritchie et al., 2015), a finding not supported by the current study. This discrepancy in findings is likely due to those studies subsuming EPT born children with the VPT group, demonstrating the importance of considering these two groups as distinct samples at least in this area of research. Finally, the nature of friendships and peer-relationships as shown in the current study, highlight that EPT born children may be selectively affected for poorer social outcomes.

Examination of family social background and concurrent child characteristics associated with peer relationship difficulties and frequent peer-victimizations revealed that, consistent with mainstream developmental studies (Hamilton et al., 2015; Puhl & King, 2013; Verlinden et al., 2015), the main risk factors were poorer physical, behavioural, and cognitive outcomes. Given the higher rates of neurodevelopmental impairments amongst VPT and EPT born children (Saigal & Doyle, 2008; Woodward et al., 2009) this possibly explains their higher proportions of being victimized by their peers as they may look physically different (e.g., lighter, shorter; Hack et al., 2003; Pierrat et al., 2011), and/or behave differently thereby appearing more vulnerable or provocative (Nadeau et al., 2004). It is noteworthy that the risk factors identified in the current study are highly consistent with other similar studies (Grindvik et al., 2009; Samara, Marlow, Wolke, et al., 2008; Yau et al., 2013) from the Scandinavia, UK, and the USA suggesting that despite sociocultural differences there are universal factors that contribute to the friendship, peer, and victimization experiences of these high-risk children. One plausible mechanistic hypothesis would involve altered origins and/or poor subsequent growth and maturation of specific brain regions such as amygdala, hippocampus, insula, thalamus, orbitofrontal cortex, prefrontal cortex, and cerebellum, which can contribute to impaired social functioning in these children (Bora, Pritchard, Chen, Inder, & Woodward, 2014; Healy et al., 2013; Rogers et al., 2012; Spittle et al., 2009).

Study findings provide evidence for avenues of intervention for professionals who work with these high-risk children and their families. Interventions should aim to address social development as well as other neuro-developmental difficulties and should be multi-systemic. Interventions that are multi-systemic have been demonstrated as better than isolated interventions in order to promote the use of skills across contexts, which ultimately enhance learning of skills

(Hair, Jager, & Garrett, 2002; Mize, 2005). Intervention strategies targeted at social development should involve the enhancement of opportunities of these children to make friends and engage with peers. This could be done via peer mentoring within the school context, where socially competent peers are encouraged to support children with peer relationship difficulties, and include them, particularly those with disabilities (Carr, 2006; Mize, 2005). During preadolescence, the key areas of peer-support intervention may be to increase positive affect, encourage sharing emotions and experiences, affection, appropriate power sharing, and meeting emotional needs (Hair et al., 2002; Mize, 2005). Furthermore, interventions should particularly focus on utilising these at-risk children's personal strengths (e.g. through music) which may increase their opportunity to develop friends while simultaneously increasing their positive affect and self-efficacy. Interestingly, an increased sense of self-confidence can increase the subjective level of peer connectedness reported by children. For example, a longitudinal study conducted in New Zealand on children in early adolescence (average age 12 years) showed that increased levels of self-confidence during early adolescence lead to higher scores of peer connectedness three years later (Jose et al., 2012).

In addition to peer focused intervention, also enhancing the parent-child relationship via encouraging the parent to model, instruct and prompt socially competent behaviour would also help these children (Hair et al., 2002; Mize, 2005). During preadolescence, the key areas of parental encouragement include closeness, teamwork, and spending time with the child (Hair et al., 2002). Furthermore, 'enriched environments' (such as having play opportunities and predictable routines; Keltner, 1990) have been shown to promote resilience in at-risk children including those born EPT/VPT/VLBW (Keltner, 1990; McCormick, Workman-Daniels, & Brooks-Gunn, 1996; Treyvaud, Inder, et al., 2012; Weisglas-Kuperus, Baerts, Smrkovsky, & Sauer, 1993). At a broader context, school policies that aim to reduce bullying by educating teachers, parents and children and increasing acceptance of physical and behavioural differences may also prove beneficial.

It is becoming clear that children born EPT/VPT should have access to programmes during early childhood such as the Incredible Years (IYP) or Triple P programmes which teach emotional skills, friendship and social skills, anger management and how to be successful at home and at school (Sanders, Kirby, Tellegen, & Day, 2014; Webster-Stratton & Reid, 2004b). The IYP programme can be a classroom based systemic approach and has been shown to be effective in New Zealand in reducing problem behaviours and increasing child wellbeing including social competence (Fergusson, Stanley, & Horwood, 2009), while the Triple P programme has also demonstrated benefits in local New Zealand research (Salmon, Dittman, Sanders, Burson, & Hammington, 2014).

Finally, several limitations should be acknowledged while interpreting these findings. First, despite being a regional cohort, the sample sizes for the EPT and VPT groups were relatively smaller

which may impact on the statistical power for reported results. Second, as only concurrent child factors were considered, the temporal ordering of children's experiences remains unclear. Taking a longitudinal approach as well as including other factors such as socio-cognitive skills (e.g. emotion regulation), social performance (e.g. prosocial behaviour), family functioning and parenting styles will be an important next step. It is important to understand the critical time period when these peer relationship problems emerge and to examine the trajectory of peer problems over time, along with identifying potential risk factors that may be associated with a poorer trajectory. Therefore, these important aspects will be the focus of the next two chapters. Despite the limitations, the current study is novel in profiling the friendship and peer relationship characteristics of preterm children during preadolescence years. Overall, findings show that EPT born children are at-risk of having no friends, experiencing peer problems, and/or being frequently victimized compared with VPT and FT born children.

"I got teased about my size, my weight and they kept calling me a '*noob'* since I wear glasses."

– Male participant born EPT (24 weeks gestation).

Chapter Seven

The Social Skills and Social Performance of EPT/VPT Born Children at Age 12 Years

Preliminary research shows that EPT/VPT born children are at an increased risk of social adjustment difficulties (Ritchie et al., 2015). Consistently, the previous chapter showed that children born EPT remained at increased risk of social adjustment difficulties, namely friendship and peer problems, at age 12 years compared to children born VPT and FT. Furthermore, both EPT and VPT born children were at risk of being victimised by their peers, in line with recent research of EPT/VPT born children in middle childhood (age 8 years) and early adolescence (age 11 and 13 years; Wolke et al., 2015).

These results provide important information about the overall social adjustment outcomes for children born EPT and VPT at age 12 years. Social competence, however, is a complex construct which has not been comprehensively studied within studies in the preterm literature (Cavell, 1990; Ritchie et al., 2015; Rubin & Rose-Krasnor, 1992). The tri-component model of social competence which formed a framework for the present research conceptualises social competence as comprised of three components, with the two lower components, social skills and social performance, theorised to partly influence these social adjustment outcomes (Cavell, 1990). As such, examining the friendship and peer relationship difficulties of these children only captures their social adjustment. Examination of the lower two components is not only more comprehensive but should also theoretically aid understanding of why EPT born children have more adverse social adjustment outcomes in comparison to their FT born peers. Yet, to date, few studies looking at the social development of EPT/VPT born children have comprehensively examined all three components (Ritchie et al., 2015).

Studies have, however, examined components of the tri-component model in isolation (e.g. only social skills, or only social performance outcomes). These studies have found social skills

in EPT born children to be less developed compared to children born FT. For example, children born EPT/VPT have been shown to have poorer compliance, attention, self-management, mastery motivation, emotional regulation, empathy and positive play skills compared with FT peers at age 2 and 4 years (Spittle et al., 2009b; Jones et al., 2013; Scott et al., 2012). In contrast, socio-cognitive skills (measured by theory of mind tasks) were not found to be impaired in EPT/VPT born children compared with their FT peers at age 4 years (Jones et al., 2013).

Social performance can be measured by prosocial behaviour, aggressive behaviour and frequency of interaction with others (Yeates et al., 2014). Firstly, in terms of prosocial behaviour, evidence is conflicted (Ritchie et al., 2015). Some studies have found EPT born children (but not VPT born children) to have poorer prosocial behaviour throughout childhood compared to FT born children (Delobel-Ayoub, Kaminski, Marret, Burguet, Marchand, N'Guyen, Matis, Thiriez, Fresson, Arnaud, Poher, Larroque, & Grp, 2006; Elgen et al., 2012; Samara et al., 2008). Furthermore, males, those born at the earliest gestational ages, those with more health and development difficulties and/or those with lower cognitive ability have been found to be at the highest risk of prosocial behaviour difficulties (Bayless et al., 2008; Delobel-Ayoub, Kaminski, Marret, Burguet, Marchand, N'Guyen, Matis, Thiriez, Fresson, Arnaud, Poher, Larroque, & Grp, 2006; Elgen et al., 2012; Samara, Marlow, & Wolke, 2008). Other studies, however, have found no evidence to suggest that there are any differences in prosocial behaviour between EPT/VPT and FT born children (e.g.Baron & Rey-Casserly, 2010; Delobel-Ayoub, Arnaud, White-Koning, Casper, Pierrat, Garel, Burguet, Roze, Matis, Picaud, Kaminski, & Larroque, 2009; Treyvaud, Doyle, et al., 2012). Additionally, studies examining the aggressive behaviour of EPT/VPT born children have not found them to engage in more aggressive behaviour compared to FT born children at age 6 or 11 years (Farooqi et al., 2007; Scott et al., 2012). Finally, no studies have investigated whether EPT/VPT born children interact with their friends less frequently than FT born children, although two studies suggest EPT/VPT born children are less involved in team activities, clubs and organizations at age 10 and 11 years (Farooqi et al., 2007; Vederhus et al., 2010a). On balance, existing research suggests then that EPT and to a lesser degree VPT born children are at increased risk of difficulties throughout childhood in certain aspects of the social skill and social performance components of the tri-component model.

Although the tri-component model of social competence provides a comprehensive research framework, the hypothesis that social skills and social performance components influence social adjustment outcomes has not been quantitatively evaluated in the preterm or the general literature. Preliminary general population studies examining isolated aspects of the tri-component model suggest that the hypothetical relationships do exist. For example, increased levels of social

skills, prosocial behaviour and less aggressive behaviour have been shown to positively influence social interactions and social acceptance and result in fewer peer problems (Carr, 2006; Geldard & Geldard, 2008; Ladd, 1990; Rubin & Rose-Krasnor, 1992; Hatzichristou & Hopf, 1996; Ladd, Price & Hart, 1988; Boulton, 1999; Dodge, McClasky & Feldman, 1985; Phillipsen, et al., 1999). It is unknown, however, whether this framework helps to explain the poorer social adjustment outcomes seen in EPT born children. The tri-component model also acknowledges that a wide range of developmental variables influence the overall social adjustment outcome in children and adults. It may be that there are consequences of EPT and VPT birth extraneous to social development, such as low cognitive ability, that explain the poorer social adjustment outcomes of these children.

In line with this, preliminary findings suggest that a number of baseline and concurrent child and family factors are associated with EPT/VPT born children's increased risk of social difficulties. These include being of male sex, and having poorer cognitive development, and lower SES (Jones et al., 2013; Ritchie et al., 2015; Spittle et al., 2009b). Furthermore, the previous chapter showed having lower math fluency scores, higher levels of hyperactivity/inattention, more emotional difficulties, poorer physical status, and poor vision to be related to poor social adjustment outcomes at age 12 years. The extent to which each of these factors plays in accounting for the increased risk of peer problems EPT/VPT born children experience is unknown. It is also unknown whether they are more or less influential on social adjustment outcomes than the social skill and social performance components.

Therefore, the aims addressed in this chapter are to: 1) assess whether there are differences between EPT, VPT and FT born children in the two lower components of the tri-component model of social competence, social skills and social performance; 2) examine the tri-component model of social competence as a framework for explaining the between-group differences in social adjustment outcomes; and 3) examine the role of social skill and social performance outcomes in explaining the between-group differences in social adjustment outcomes, in combination with, and in comparison to a wider range of developmental child and family variables.

7.1 Method

7.1.1 Sample. Within the current study, there were 44 EPT born children, 60 VPT born children, and 109 FT born children. The sample selection process and the sample characteristics have been described previously (pages 52 - 56, Chapter Five).

7.1.2 Procedure. The procedure has also been described previously (pages 56 - 60, Chapter Five).

7.1.3 Assessment: measures and informants. This chapter is primarily concerned with the social skill and social performance components of the tri-component model. Table 7.1 summarizes the specific social outcomes assessed in the current study and which informant reported on each one. All measures were completed at age 12 years.

Table 7.1: Outcomes of Social Skills and Social Performance Measured in the Present Study, and the Informant Who Reported on Each Outcome.

Measure	Child	Parent	Teacher
Social Skills			
Interpersonal Skills			X
Socio-cognitive skills			
Parent and Friend Attachment	X		
Rejection Sensitivity	X		
Social Performance			
Prosocial Behaviour		X	X
Aggressive Behaviour	X	X	X
Frequency of Social Interaction	X	X	

Social skills. As described previously (page 61), the social skills measured in this thesis include interpersonal skills and social-cognitive skills.

Interpersonal skills. Interpersonal skills relate to those skills that are directly related to social competence. Items in this section were custom written and were: *Group work skills; social and co-operative skills; and relating to others*. Teachers were asked to rate the child in comparison to their classmates, on a five-point Likert scale from 'Well above average' (coded as 1), to 'Average' (coded as 3), to 'Poor' (coded as 5). Items were summed to give an overall composite score ranging from 3-15, with higher scores reflecting more social skill difficulties. These three items had good internal reliability (Cronbach's Alpha = .92).

Rejection sensitivity. The Child Rejection Sensitivity Questionnaire (CRSQ;Downey, Lebolt, Rincon, et al., 1998) is a self-report six item questionnaire for 9-14 year olds that measures interpersonal rejection sensitivity among peers. The questionnaire has six fictional scenarios and asks each child to imagine each one happening. An example of a scenario is as follows: *"Imagine you had a really bad fight the other day with a friend. Now you have a serious problem and you wish you had your friend to talk to. You decide to wait for your friend after class and talk with him/her. You wonder if your friend will want to talk to you."* After each scenario the child rates: 1) how nervous they would be; 2) how mad they would be; and 3) how likely the other people in the situation would be to help/include/choose them (depending on the situation). Children rated their answer on a five point Likert scale from 'Not at all nervous/mad' to 'Very, very nervous/mad' for the first two questions after each scenario. The rating scale for the final question regarding how likely others would reject them included 'Yes', 'Kind of, yes', 'Maybe' 'Not really, no', and 'No'. This questionnaire has two subscales, anxious rejection and angry rejection which were scored by

multiplying the anxious or angry response for each item with the likelihood they believe they will experience rejection. The six resulting anxious and the six resulting angry scores were then added and divided by six to find the average for each of the anxious and angry subscales. This scale has well-established reliability and validity (Downey, Lebolt, Rincon, et al., 1998). Cronbach's alpha for this sample was .81 (anxiety subscale) and .83 (angry subscale). Both subscales had strong correlations with each other (.76).

Attachment to parents and friends. The degree of attachment security a child has with their parents and their friends was measured using the 25 item Inventory of Peer and Parent Attachment - Revised (IPPA-R; Gullone & Robinson, 2005). An example of an item is "*I feel silly or ashamed when I talk about my problems with my friends.*" The children rated how true each statement was for them on a five-point Likert scale from 'Not at all true' to 'Really true'. Double negative items were reworded to avoid any confusion with answering. The IPPA-R has three subscales for parents and friends separately: alienation (seven items); communication (nine items); and trust (nine items). The items for communication, trust and alienation subscales were summed then divided by the number of items in the subscale in order to get three mean subscale scores. Then, to obtain two overall measures of parent and friend attachment, the total of the summed scores of the trust and communication subscales were added together and the alienation scales were subtracted from the combined scores of these scales. This questionnaire has moderate to high reliability and validity (Gullone & Robinson, 2005). Cronbach's alpha for this sample was .70 (parent attachment) and .88 (friend attachment). The two subscales were moderately associated (.30).

Social performance.

Prosocial behaviour. Prosocial behaviour is measured using the SDQ (Goodman, 1997) which was described in Chapter Six (page 70 and 73). This scale consists of five items such as "*Considerate of other people's feelings*" and "*Often volunteers to help others*". Items were rated by parents and teachers on a 3-point Likert scale based on the child's behaviour over the last 6 months, with lower scores indicating poorer prosocial behaviour. A combined report of summed parent and teacher scores was used for regression analyses. It is important to note that, the SDQ labels this subscale '*prosocial skills'* however on face value these prosocial items are observable behaviours that occur during social interactions and thus more directly represent social performance. This was confirmed with personal communication with Tim Cavell, who conceptualised the tri-component model (2014). The Cronbach alpha for this sample was .73 for parent report and .78 for teacher report indicating good internal reliability.

Aggressive behaviour. The frequency and type of bullying a child was involved in was measured using the 16 item Multidimensional Peer Victimization Scale (MPVS; Mynard & Joseph,

2000) described in detail in Chapter Six (page 71). Bullying in this thesis is defined as a situation where an individual exploits another person by physically, and/or verbally attacking them, destroying or stealing their property and/or acting in a manipulative way to turn people against them or get them excluded (Mynard & Joseph, 2000; Rigby, 2008). In order to measure bullying behaviour, the peer-victimization items were changed to ask if the children had directed any of the bullying acts toward other children in the last six months. Example items included "*I stole items from someone"* and "*I told lies or spread rumours about someone*". Responses were recorded on a five-point scale from "Not at All", "Once or Twice", "2−3 times per month", "Weekly", or "Several times per week". The internal reliabilities of the four subscales were mixed. Cronbach's alpha's were satisfactory for physical (.73), verbal (.69) and property bullying (.77) and was not satisfactory for social manipulative bullying (.51). Therefore, for the purposes of the current study, a variable was computed to indicate if a child reported being a bully of any type in the past six months. Four dichotomous variables were also created by categorising children as having perpetrated that type of bullying if the child reported engaging in any of the bullying acts for each of the four types of bullying (physical, verbal, property and social manipulation).

Additionally, parents and teachers were asked if the child was a bully to other children as part of the SDQ. If the informant reported this was 'somewhat true' or 'true' for the child, the child was coded as a bully. Child, parent and teacher reports were then collated to indicate if any of the informants reported that the child was a bully or not. This collated information was then used as a summary variable for aggressive behaviour in the regression analyses.

Frequency of social interaction. Children and parents were asked how often the child spent time with their friends. Children could select 'never', '1-2 times per week', '3-4 times per week' and 'always'. Although this variable represented their social performance, it was reported within the friendships section in Chapter Six in order for all friendship profile data to be displayed together. Within this chapter, social interaction is included with other social performance variables. A dichotomous summary variable was created to indicate whether the child or parent reported that the child never spent time with their friends each week. This dichotomised variable was then used as a summary variable for frequency of social interaction in the regression analyses.

Associated risk factors used in regression. *A priori* theoretical knowledge and correlation coefficients were used to determine the variables included in the regression analysis. Three distinct areas were hypothesized to influence the children's social adjustment outcomes. These were 1) baseline and family characteristics, 2) 12-year social skills, 3) 12-year social performance and 4) associated risk factors. The 12-year associated risk factor variables that were entered into the regression analyses have been described in a previous chapter (math fluency,

hyperactivity/inattention, emotional difficulties, vision problem, high BMI, pubertal development; Chapter Six, pages 72 - 74).

7.1.4 Data analysis. Data analysis was conducted in four stages. First, between-group mean differences in children's social skills, and their prosocial and aggressive behaviour were examined. Multivariate analysis of variance (MANOVA) and one-way ANOVA for continuous variables were used. Pillai's Trace test of significance (a more statistically robust test) was used due to the different sample sizes between the three groups (Pallant, 2013; Tabachnick & Fidell, 2013). All analyses were followed by post-hoc comparisons using Gabriel's procedure and the Games-Howell procedure (see page 74, Chapter 6). Both procedures consistently yielded the same results for all items except for the angry rejection sensitivity subscale. The post-hoc tests presented in Tables 7.2 and 7.3 are therefore all based on Gabriel's procedure except for the angry rejection sensitivity subscale for which Games-Howell is also provided in the Table notes. Pearson's Chi-square test or Fisher's exact test were used for categorical variables.

Second, bivariate correlations were examined between the social skill, social performance, social adjustment outcomes and associated child and family factors that were identified in the previous chapter (described on pages 72 - 74). All social skill, social performance and child and family factors were theoretically hypothesised to be associated with the outcome variables (peer relationship problems and frequent victimization) or had been demonstrated to have a statistically and practically significant association and were subsequently included in the regression model. Associations were assessed to make sure there were no variables entered into the same block that were highly correlated (>.50) to avoid problems with multi-collinearity and singularity.

Binary logistic regression modelling was then used to determine whether social skill and social performance variables were associated with children's increased risk of peer relationship difficulties and frequent victimization. Due to the low sample size of EPT born children, all three groups were pooled and birth status was entered as one categorical predictor into the regression model where EPT birth status = 1, VPT birth status = 2 and FT birth status = 3. Within the regression, EPT and VPT groups were then compared against the FT group which was the reference category. Results are displayed for each comparison (EPT vs FT and VPT vs FT) in separate rows of the result tables. Variables were entered into the regression equation in three distinct blocks in order of theoretical and temporal influence. These were 1) birth status, 2) 12-year social skill variables, and 3) 12-year social performance variables.

Finally, binary logistic regression modelling was used to determine whether the social skill and performance variables and the associated child and family factors would continue to explain children's increased risk of peer relationship difficulties and frequent victimizations when included

in the model simultaneously. Gestational groups were again pooled and birth status included as a baseline characteristic. Variables were entered into the regression equation in four distinct blocks namely, 1) baseline and family characteristics, 2) 12-year social skills, 3) 12-year social performance and 4) 12-year characteristics. Only social skill and social performance variables found in the first logistic regression (in this chapter) to be independently associated with social adjustment outcomes were entered into these second regression models. Model fitting was performed using both forwards and backwards variable selection to identify the most parsimonious model, with a $p <$ .05 criterion used to retain variables in the final model.

7.2 Results

7.2.1 Between-group differences in social skills. A MANOVA with the five social skills variables as dependent variables showed that there was a statistically significant difference between the three gestational groups [Pillai's Trace = 0.11, F (10, 394) = 2.21, p = .02, η_p^2 = .05]. Inspection of the univariate ANOVAs for each of the social skill outcomes (Table 7.2) shows that the three gestational groups only differed significantly on interpersonal skill difficulties [F (2, 205) = 6.63, p = .002, η_p^2 = .06]. Post-hoc analyses revealed that, according to teacher report, children born EPT had poorer interpersonal skills than FT born children (p = .001) and the effect size was moderate (Cohen's d = 0.7). The between-group difference remained statistically significant after adjustment for family SES (p = .003) and maternal education (p = .007). VPT born children did not significantly differ from FT born children on interpersonal skills (p = .38, Cohen's d = 0.2).

All three gestational groups reported more anxious rejection sensitivity than angry rejection sensitivity. As can be seen in Table 7.2, the EPT born children had greater variability in their anxious and angry rejection sensitivity scores than the remaining two groups suggesting that the scores of the children born EPT span a wider range than the other two groups of children.

Table 7.2: Univariate ANOVA results for Extremely Preterm, Very Preterm and Full-Term Children's Social Skills at Age 12 years.

Domain	EPT (*n*=44)	VPT (*n*=60)	FT (*n*=108)	*p-values*				η_p^2
				Overall^	EPT vs VPT	EPT vs FT	VPT vs FT	
Interpersonal Skill Difficulties								
Teacher Report, *M(SD)*	9.7 (2.8)	8.6 (2.6)	7.9 (2.7)	.002	.10	<.001[a]	.38	.06
Socio-cognitive Skills								
Anxious Rejection Sensitivity, *M(SD)*	6.2 (3.8)	5.8 (2.9)	6.3 (2.9)	.56	.86	1.0	.64	.006
Angry Rejection Sensitivity, *M(SD)*	5.3 (3.3)	4.1 (1.8)	4.7 (2.3)	.04	.08*	.45	.27	.03
Parent Attachment, *M(SD)*	4.2 (0.8)	4.2 (0.9)	4.3 (0.8)	.93	1.0	.99	.98	.001
Friend Attachment, *M(SD)*	6.7 (1.9)	6.5 (1.7)	6.4 (1.8)	.62	.90	.68	.98	.005

Note: EPT: Extremely Preterm; VPT: Very Preterm; FT: Full-Term; ^ ANOVA p-value from comparison between all three gestational groups; M: Mean; SD; Standard Deviation; [a] remained significant after adjustment for family socio-economic status and maternal education. * All analyses were followed by post-hoc comparisons using Gabriel's and Games-Howell procedure. Both procedures yielded consistent results so p-values are displayed for Gabriel's post-hoc results for all analyses except for angry rejection sensitivity which did not reach significance using Games-Howell procedure. Games-Howell is provided for angry rejection sensitivity. η_p^2 > 0.01 considered small, >0.06 considered medium, and >0.14 considered large effects.

Table 7.3: Univariate ANOVA and Chi-Square Tests for Independence results for Extremely Preterm, Very Preterm and Full-Term Children's Social Performance Outcomes at Age 12 years.

Domain	EPT (*n*=44)	VPT (*n*=60)	FT (*n*=109)	*p-values*				η_p^2 / Cramer's V
				Overall^	EPT vs VPT	EPT vs FT	VPT vs FT	
Prosocial Behaviour								
Parent Report, *M (SD)*	8.2 (2.4)	8.6 (1.5)	8.6 (1.5)	.53	.73	.60	1.0	.006
Teacher Report, *M (SD)*	6.6 (2.4)	7.3 (2.1)	7.7 (2.0)	.02	.21	.01 [a]	.69	.04
Child a Bully to Other Children								
Parent Report, %	11.4	11.7	9.2	.87	1.0	.77	.79	.04
Teacher Report, %	16.7	11.9	8.4	.36	.69	.15	.58	.10
Child Report, %	52.4	32.2	47.2	.09	.07	.59	.07	.15
Type of Bullying								
Any Physical, %	19.0	11.9	23.1	.25	.47	.67	.10	.12
Any Verbal, %	40.5	23.7	25.9	.14	.11	.11	.85	.14
Any Property, %	21.4	6.8	11.1	.07	.06	.12	.42	.16
Any Social Manipulation, %	35.7	18.6	26.9	.17	.09	.32	.26	.13

Note: EPT: Extremely Preterm; VPT: Very Preterm; FT: Full-Term.; ^ ANOVA p-value from comparison between all three gestational groups; M: Mean; SD: Standard Deviation; %: Percentage of children with significant difficulties; [a] remained significant after adjustment for family socio-economic status and maternal education. All analyses were followed by post-hoc comparisons using Gabriel's procedure. η_p^2 > 0.01 considered small, >0.06 considered medium, and >0.14 considered large effects. Cramer's V were considered small if the value was > 0.1, moderate if the value was > 0.3 and strong if the value was > 0.5.

There were no statistically significant differences found between the three groups in terms of their anxious or angry rejection sensitivity (p = .56, and p = .08, respectively). Finally, all three gestational groups reported similarly high levels of attachment to both friends and parents (all p > .62, Cohens d's ≤ 0.2).

7.2.2 Between-group differences in social performance. Table 7.3 displays the results for between-group differences of the social performance variables. Teachers reported poorer prosocial behaviour for children across all three groups compared to parents. Results of a univariate ANOVA showed there was an overall between-group difference for prosocial behaviour according to teacher report [F (2,206) = 4.09, p = .02, η_p^2 = .04] but not parent report [F (2, 210) = 0.64, p = .53, η_p^2 = .006]. Post-hoc analyses identified that EPT born children were rated by teachers as having poorer levels of prosocial behaviour than FT born children which had a moderate effect size (p = .01; Cohen's d = 0.5). This pairwise difference remained significant after adjustment for family SES (p = .03), and maternal education (p = .007).

Results of Chi-Square analyses showed that there were no statistically significant differences in the proportions of children within each gestational group identified as a bully according to parent, teacher or child report (p > .09, all Cramer's V < .15). The most common types of bullying perpetrated by all study children were verbal and social manipulative bullying with 36 to 41% of EPT born children, 19 to 24% of VPT born children and 26 to 27% of FT born children reporting to have engaged in these bullying acts. There were no between-group differences in the proportion of those who reported perpetration of physical bullying (p = .25), verbal bullying (p = .14), property bullying (p = .07) or social manipulation bullying (p = .17).

7.2.3 Examination of the tri-component model components in explaining social adjustment outcomes. Next, the current study examined the extent to which social skill and social performance variables were associated with social adjustment outcomes (peer relationship problems and frequent victimization) at age 12 years. Table 7.4 displays the bivariate correlations between all variables including all social outcome variables and child and family factors. This table is organised by baseline characteristics (Rows/Columns 1-4), 12-year physical and cognitive outcomes (Rows/Columns 5-12), social skill outcomes (Rows/Columns 13-17), social performance outcomes (Rows/Columns 18-20), 12-year SDQ subscale outcomes (Rows/Columns 21-23) and then social adjustment outcomes (Rows/Columns 24-26). All social skill and social performance variables had statistically significant correlations with the peer problems or peer connectedness outcomes (Columns 22 & 24). All social skill variables had statistically significant correlations with the victimization outcome variable (Column 23). Furthermore, most social skill and social performance variables had associations of moderate

Table 7.4: Bivariate Correlation Coefficients Between Baseline and 12 year Child Factors and Social Outcome Variables

		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Baseline	1. Birth Status	-.06	**-.19**	-.02	**-.19**	**-.21**	-.02	-.05	**.31**	**.32**	**.37**	**.24**	**-.23**	.10	.02	-.09	.01	.12	-.07	**-.15**	**-.23**	-.10	**-.28**	**-.29**	-.07	.01
	2. Sex*		.06	.02	.01	.03	.05	-.06	.03	.03	-.01	**-.14**	-.12	**.23**	.13	**.22**	.02	**.15**	-.05	-.08	.01	**-.17**	**-.22**	-.09	.03	.06
	3. Socio-economic Status			**-.23**	.05	-.04	**.16**	.01	**-.15**	**-.24**	-.11	-.04	**.18**	-.01	.04	.02	.13	**-.14**	.08	.13	.06	**.18**	**.20**	**.16**	**.15**	.07
	4. Maternal Age				.02	.11	-.08	-.13	-.05	.06	-.07	.05	.07	**-.**11	-.11	.09	.04	-.10	**.15**	-.03	.07	-.04	-.04	.02	**-.15**	-.11
12 Year Concurrent Characteristics	5. Vision Problem*					.08	-.02	.05	**-.25**	**-.14**	**-.36**	-.07	.12	.11	.03	-.08	-.07	.01	.04	.09	**.23**	.08	.13	**.29**	**.19**	-.08
	6. Low BMI*						-.09	**-.35**	-.06	-.06	-.03	-.07	.05	.03	-.01	.04	-.02	.03	-.11	-.02	.10	-.01	.01	.08	-.08	.00
	7. High BMI*							.06	.02	-.06	**-.18**	-.02	.02	.06	.12	-.12	-.03	.00	.04	.11	.09	.06	.04	.07	.11	.05
	8. Pubertal Development								.01	.03	-.04	.00	-.06	**.14**	.10	-.06	-.03	-.08	-.06	**.17**	-.05	.01	.07	-.07	.04	-.01
	9. Math Fluency									**.61**	**.40**	**.23**	**-.30**	-.03	.03	.06	.01	.12	-.08	**-.16**	**-.30**	**-.17**	**-.34**	**-.39**	**-.15**	**.29**
	10. Full Scale IQ Score										**.44**	.09	**-.39**	.04	.00	.00	-.06	.13	**-.15**	-.08	**-.34**	**-.28**	**-.46**	**-.34**	-.12	**.17**
	11. Total Motor Score											**.31**	**-.32**	-.02	-.13	**.21**	.03	**.14**	**-.18**	**-.26**	**-.32**	**-.23**	**-.32**	**-.51**	**-.16**	**.16**
	12. Team Sport*												**-.24**	-.11	-.12	.09	.03	**.17**	-.04	-.10	**-.22**	-.08	-.13	**-.31**	**-.13**	.02
Social Skills	13. Interpersonal Skill Difficulty													.03	**.18**	**-.18**	-.02	**-.55**	**.41**	**.18**	**.34**	**.42**	**.66**	**.52**	**.26**	**-.28**
	14. Anxious Rejection Sensitivity														**.76**	**-.23**	**-.27**	-.02	-.07	.04	.10	.02	-.02	.13	**.29**	**-.28**
	15. Angry Rejection Sensitivity															**-.35**	**-.25**	**-.14**	.02	**.17**	.12	.09	.10	**.15**	**.38**	**-.32**
	16. Friend Attachment																**.30**	**.23**	-.05	-.07	-.11	**-.19**	**-.22**	**-.19**	**-.30**	**.35**
	17. Parent Attachment																	.11	-.07	-.02	-.07	-.07	-.04	-.05	**-.14**	**.23**
SP	18. Prosocial Behaviour																		**-.40**	**-.17**	**-.15**	**-.43**	**-.52**	**-.33**	-.10	**.23**
	19. Child Bullies*																			**.14**	**.15**	**.78**	**.40**	**.32**	**.15**	**-.16**
	20. Never Sees Friends*																				**.21**	**.14**	**.17**	**.34**	**.14**	-.12
SDQ	21. Emotional Difficulties																					**.26**	**.39**	**.50**	**.18**	**-.19**
	22. Conduct Problems																						**.55**	**.39**	**.19**	**-.18**
	23. Hyperactivity/Inattention																							**.43**	**.25**	**-.25**
SA	24. Peer Problems																								**.40**	**-.35**
	25. Frequency of Victimisation																									**-.39**
	26. Peer Connectedness																									

Notes: *Dichotomous variables used for associations; BMI: Body Mass Index; SP: Social Performance Variables; SDQ: Strengths and Difficulty Questionnaire Subscales; SA: Social Adjustment Outcome Variables; Bold text indicates statistically significant correlation where $p < .05$.

strength (>.30) with one of the three outcome variables (peer problems, peer connectedness and/or frequency of victimization). Parent attachment and anxious rejection sensitivity had correlations of small strength (parent attachment had a highest correlation coefficient of .23 with peer connectedness; and anxious rejection sensitivity which had a highest correlation coefficient of .29 with frequency of victimization). However, due to the theoretical importance of all of these variables, and their statistically significant and moderate associations with the outcome variables, all social skill and social performance variables were entered in the regression models. As anxious rejection and angry rejection were highly correlated (.76) the models were run twice, with anxious and angry rejection entered separately to investigate the best fitting model. Table 7.5 displays the final fitted regression model containing the social skill or social performance variables regressed onto a) peer relationship problems and b) frequent victimization at age 12 years.

Peer relationship problems. The first model for peer relationship problems shows that having more interpersonal skill difficulties, poorer parent and/or friend attachment, higher levels of anxious rejection sensitivity, involvement in bullying behaviour and never interacting with friends were associated with peer problems at age 12 years. Every unit score lower on the interpersonal difficulties scale resulted in 1.4 times higher odds of having peer problems (OR = 1.35, 95% CI = 1.13, 1.63, p = .001) and every unit score higher on the parent attachment scale resulted in almost two times lower odds of having peer problems (OR = 0.57, 95% CI = 0.35, 0.94, p = .03). Every unit score higher on the friend attachment measure resulted in 1.4 times lower odds of having a peer problem (OR = 0.74, 95% CI = 0.59, 0.93, p = .01). Every unit score higher on the anxious rejection sensitivity subscale resulted in a 1.2 higher odds of having peer problems (OR = 1.18, 95% CI = 1.03, 1.35, p = .02). If a child was reported to be a bully or never interacted with friends they had three times the odds of having peer problems than if they were not (OR = 3.24, 95% CI = 1.13, 9.29, p = .03; and OR = 3.14, 95% CI = 1.18, 8.37, p = .02, respectively). Poorer prosocial behaviour was not associated with having peer problems at age 12 years. As EPT born children had poorer outcomes in these domains compared to VPT and FT born children, it may be that having poorer interpersonal skills and less interaction with friends is partly explaining why EPT born children have poorer peer relationships at age 12 years. In the final model EPT birth status was on the border of statistical significance (OR = 2.80, 95% CI = 1.00, 7.82, p = .05). Overall, this model was statistically significant and explained between 33% (Cox and Snell R^2) and 47% (Nagelkerke R^2) of the variance in the participants' risk of peer problems at age 12 years [X^2 (8, n = 199) = 78.55, p < .001].

Frequent victimization. Despite the components of the tri-component model explaining a good amount of variance of the peer relationship problems outcome at age 12 years, only social

skill variables played a role in explaining the outcome for frequent victimization. Specifically, higher levels of interpersonal skill difficulties and higher levels of angry rejection sensitivity were associated with being victimized at age 12 years. Every unit score higher on the interpersonal difficulties scale resulted in 1.3 times higher odds of being frequently victimised at age 12 years (OR = 1.32, 95% CI = 1.05, 1.66, p = .02). Every unit score higher on the angry rejection scale also resulted in a 1.3 times higher odds of being frequently victimised (OR = 1.29, 95% CI = 1.04, 1.59, p = .02). In other words, a higher score of three points on either of these measures put the children at two times higher odds of being frequently victimized compared to children with scores three points lower than them. As EPT born children had poorer interpersonal skills compared to VPT and FT born children it may be that poorer interpersonal skills is partly explaining why EPT born children are at risk of frequent victimization at age 12 years. VPT birth status remained statistically significant in this model (OR = 5.70, 95% CI = 1.32, 24.66, p = .02) suggesting that although difficulties with social skills are associated with being frequently victimized, there are also additional factors playing a role in the increased risk of victimization at age 12 years. Overall, this model was statistically significant, [X^2 (4, n = 203) = 22.07, p < .001]. This final model explained between 10% (Cox and Snell R^2) and 24% (Nagelkerke R^2) of the variance in the participants' risk of being victimized.

7.2.4 Factors explaining between-group differences in social adjustment outcomes. Next, all significant social skill, social performance and associated 12-year concurrent factors (identified in Chapter Six) were regressed onto the social adjustment outcomes (peer relationship problems and frequent victimization) in one model. This was conducted in order to examine the contribution of all of the variables on the children's social adjustment outcomes. Table 7.6 displays the final fitted model of the significant social skill, and social performance variables in combination with the significant child and family factors (identified in Chapter Six). The results show that a combination of social variables as well as child and family factors are independently associated with peer problems over and above the effect of prematurity and increase the amount of variance that the model explains. Only the wider developmental variables remained independently associated with frequent victimization over and above the effects of both social skill factors and prematurity.

Peer relationship problems. Specifically, poorer parent and/or friend attachment, being identified as a bully, never spending time with friends, and having lower math fluency scores and more hyperactivity/inattention difficulties were associated with having significant peer problems at age 12 years. In line with results from Table 7.5, parent and friend attachment scores, never spending time with friends, and bully status remained statistically significant. Furthermore, math

Table 7.5: Final Fitted Regression Models with Social Skills and Social Performance Outcomes Regressed on to Peer Relationship Problems and Frequent Victimization at Age 12 Years.

Measure	Block 1 Baseline Characteristics at Birth			Block 2 12-year Social Skills			Block 3 12-year Social Performance		
	***B* (SE)**	***Exp (B)***	***p***	***B* (SE)**	***Exp (B)***	***p***	***B* (SE)**	***Exp (B)***	***p***
Peer Relationship Problem									
EPT Birth Status	1.21 (.40)	3.35	.002	1.14 (.49)	3.13	.02	1.03 (.52)	2.80	.05
VPT Birth Status	-0.04 (.40)	0.96	.92	-0.30 (.49)	0.74	.54	-0.14 (.50)	0.87	.78
Interpersonal Skill Difficulty				0.39 (.09)	1.48	.000	0.30 (.09)	1.35	.001
Parent Attachment				-0.58 (.24)	0.56	.02	-0.56 (.25)	0.57	.03
Friend Attachment				-0.28 (.11)	0.76	.01	-0.30 (.12)	0.74	.01
Anxious Rejection Sensitivity				0.14 (.07)	1.15	.04	0.17 (.07)	1.18	.02
Child is a Bully							1.18 (.54)	3.24	.03
Never sees Friends							1.14 (.50)	3.14	.02
Frequent Victimization									
EPT Birth Status	1.83 (.74)	6.24	.01	1.37 (.78)	3.94	.08	-	-	-
VPT Birth Status	1.55 (.71)	4.71	.03	1.74 (.75)	5.70	.02	-	-	-
Interpersonal Skill Difficulty				0.28 (.12)	1.32	.02	-	-	-
Angry Rejection Sensitivity				0.25 (.11)	1.29	.02	-	-	-

Note: B: Standardised Beta; SE: Standard Error; Exp (B): Odd Ratio; EPT: Extremely Preterm group compared to FT group as reference category; VPT: Very Preterm group compared to FT group as reference category.

Table 7.6: Final Fitted Regression Models for Predicting Social Adjustment Variables with Social Skills and Social Performance, Child and Family Factors at Age 12 Years

Measure	Block 1 Baseline Characteristics at Birth			Block 2 12-year Social Skills			Block 3 12-year Social Performance			Final Block 12-year Child Characteristics		
	B (SE)	***Exp (B)***	***p***	**B (SE)**	***Exp (B)***	***p***	**B (SE)**	***Exp (B)***	***p***	**B (SE)**	***Exp (B)***	***p***
Peer Relationship Problem												
EPT Birth Status	1.25 (.40)	3.50	.002	1.53 (.45)	4.60	.001	1.38 (.49)	3.99	.005	0.60 (.55)	1.82	.28
VPT Birth Status	0.00 (.41)	1.00	.99	-0.09 (.44)	0.91	.84	-0.01 (.47)	0.99	.99	-0.63 (.53)	0.54	.24
Parent Attachment				-0.59 (.23)	0.56	.009	-0.59 (.24)	0.55	.01	-0.84 (.27)	0.43	.002
Friend Attachment				-0.40 (.11)	0.67	.000	-0.43 (.12)	0.65	.000	-0.35 (.13)	0.70	.005
Child is a Bully							1.68 (.49)	5.34	.001	1.37 (.57)	3.92	.02
Child never spends time with friends							1.23 (.48)	3.43	.01	1.12 (.51)	3.07	.03
Math Fluency										-0.04 (.01)	0.96	.001
Hyperactivity/Inattention										0.16 (.06)	1.17	.01
Frequent Victimization												
EPT Birth Status	1.52 (.77)	4.56	.05	-	-	-	-	-	-	0.89 (.85)	2.44	.29
VPT Birth Status	1.46 (.72)	4.29	.04	-	-	-	-	-	-	1.15 (.81)	3.15	.15
Maternal Age	-0.12 (.05)	0.89	.02							-0.17 (.06)	0.85	.008
High Body Mass Index										2.21 (.90)	9.13	.01
Puberty Development										-1.06 (.47)	0.35	.02
Vision Problem										1.88 (.68)	6.53	.006
Hyperactivity/Inattention										0.20 (.08)	1.23	.008

Note: B: Standardised Beta; SE: Standard Error; *Exp (B)*: Odd Ratio; EPT: Extremely Preterm group compared to FT group as reference category; VPT: Very Preterm group compared to FT group as reference category.

fluency scores, and hyperactivity/inattention difficulties remained an important 12-year concurrent child characteristic (as per Table 6.4, Chapter Six, page 80). Specifically, every unit score higher on the parent attachment scale resulted in a two times lower odds of having peer problems at age 12 years (OR = 0.43, 95% CI = 0.26, 0.73, p = .002). Every unit score higher on the friend attachment scale resulted in a 1.4 times lower odds of having peer problems at age 12 years (OR = 0.70, 95% CI = 0.55, 0.90, p = .005). If the child was identified as being a bully or never spending time with friends, they were at four times and three times the odds of having peer problems respectively, than if they were not (OR = 3.92, 95% CI = 1.28, 11.98, p = .02; and OR = 3.07, 95% CI = 1.12, 8.39, p = .03, respectively). Additionally, every score higher on the math fluency task resulted in 1.04 times lower the odds of having peer problems at age 12 (OR = 0.96, 95% CI = 0.94, 0.98, p = .001). Finally, every unit score higher on the hyperactivity/inattention scale resulted in a 1.2 times higher odds of having peer problems at age 12 years (OR = 1.17, 95% CI = 1.04, 1.32, p = .01). Overall, this model was statistically significant [X^2 (8, n = 198) = 83.36, p < .001]. This final model explained between 34% (Cox and Snell R^2) and 50% (Nagelkerke R^2) of the variance in the participants' risk of peer problems at age 12.

When comparing the final model in Table 6.4 (page 80) and Table 7.5 with the final model in Table 7.6, emotional difficulties, interpersonal skill difficulties, and anxious rejection sensitivity were no longer associated with peer problems after combining the social skill, social performance and 12-year concurrent variables in the regression model. The inclusion of social skill, social performance and wider developmental and family variables explained more variance than social components or the child and family factors alone and the effect of birth status on social adjustment outcomes was reduced to statistical non-significance in the final regression model.

Frequent victimization. When applying this model to victimization, only younger maternal age at birth, having a higher BMI, less pubertal development, a vision problem, and higher levels of hyperactivity/inattention were associated with being frequently victimized at age 12 years, in line with the results presented in Chapter Six (Table 6.4, page 80). No social component variables remained associated with victimization at age 12 years after the inclusion of maternal age and concurrent child factors. Despite social variables not being associated with victimization, EPT and VPT group status were not statistically significant in the final model suggesting that the concurrent child characteristic variables included in the final model were sufficient to explain the increased numbers of children who were frequently victimized in the EPT and VPT born groups compared to the FT group.

7.3 Discussion

The results in the previous chapter showed that EPT born children were at risk of friendship and peer problems at age 12 years compared to VPT and FT born children. Furthermore, both EPT and VPT born children were at increased risk of victimization compared to FT born children at age 12 years. This chapter aimed to assess whether there are differences between EPT, VPT and FT born children in the two lower components of the social competence conceptual model, namely social skills and social performance; and to examine the role of these social components and child and family factors in explaining between-group differences in social adjustment outcomes. This discussion will cover the results and implications of the findings. Although limitations related to the overall thesis will be included in the final chapter, limitations pertinent to this chapter will be included in this discussion.

This chapter first described the social skills of the three gestational groups. EPT born children were reported to have more difficulties with interpersonal skills (such as co-operation, relating to others and group-work skills) at age 12 years compared to FT born children. This is in line with previous research which has found EPT/VPT born children to be at increased risk of social skill difficulties such as emotional regulation, compliance, and empathy during early childhood (Jones et al., 2011; Scott et al., 2012; Spittle et al., 2009b). These previous studies showed small to moderate effect sizes which were comparable with the moderate effect size found in this chapter (Cohen's $d = 0.7$). VPT born children showed a pattern in mean score differences that were in the same direction but that did not reach statistical significance suggesting that they are at an intermediate point on a continuum of difficulties between EPT and FT born children (Cohen's $d = 0.2$). This is a common trend found in social development research on EPT and VPT born children (Ritchie et al., 2015). Therefore, as well as being at increased risk of a range of other neuro-developmental difficulties, EPT born children are also at increased risk of having poor interpersonal skills. It is possible that cognitive and executive functioning tasks, possibly arising from brain abnormalities (as discussed in Chapter Six) may mean interpersonal skills are also less developed.

Reassuringly however, on the remaining socio-cognitive skills, EPT and VPT born children did not have more anxious or angry rejection sensitivity, or attachment difficulties than FT born children despite having more negative experiences with peers. EPT born children showed a larger variance in their rejection sensitivity scores suggesting that EPT born children were more widely dispersed on these measures compared to FT born children. There has been no prior research on rejection sensitivity in EPT/VPT born children, but recent research on attachment also suggests that there are no systematic differences in attachment styles between mother-child dyads of VPT/VLBW and FT born children at age 14 and 18 months (Brisch et al., 2005; Meijssen

et al., 2011). This, however, is in contrast to older research (from preterm cohorts born prior to 1990) which has shown VPT/VLBW infants to have more insecure attachment styles than FT born children (Mangelsdorf et al., 1996). Furthermore, Jones et al. (2013) found no differences between VPT and FT born children in terms of the socio-cognitive skill theory of mind, at age 4 years. These results suggest that, at age 12 years, the way that EPT born children think about others and the beliefs they hold about relationships are not significantly different to those of FT born children, despite having more difficulty with social skills and within social encounters with peers. This suggests some degree of socio-cognitive resilience (possibly due to having quality friendships when they have friends) but poses questions about whether these children can maintain helpful cognitive beliefs if continuously exposed to problematic peer relationships throughout adolescence.

Next, this chapter described the social performance of the three gestational groups. Teachers reported EPT, but not VPT born children, to display less prosocial behaviour (such as being kind, sharing and being helpful to peers) than FT born children. Although previous research has produced conflicting evidence, a number of studies have also found the EPT born children (as opposed to the VPT born children) to have difficulties with prosocial behaviour with effect sizes, in line with the moderate effect size found in the current study (e.g. Delobel-Ayoub, Kaminski, Marret, Burguet, Marchand, N'Guyen, Matis, Thiriez, Fresson, Arnaud, Poher, Larroque, & Grp, 2006; Samara, Marlow, Wolke, et al., 2008; Cohen's $d = 0.5$). Consistent with this, previous preterm literature has found those to be at the highest risk of poor prosocial behaviour are the EPT born children with neuro-developmental disabilities, health problems, and low cognitive ability (Ritchie et al., 2015). It would be beneficial, therefore, for future research to investigate what aspects of cognitive ability or disability are preventing these children from performing prosocial behaviour. It may be that physically these children are unable to engage in prosocial behaviour (e.g. help other children) or it may be that cognitive difficulties such as poorer attention skills and/or behavioural inhibition may also impact on their ability to read others' social cues or positively implement these behaviours at a well-executed time (Mash & Barkley, 2014).

In terms of aggressive behaviour, there were no differences in the proportions of EPT/VPT and FT born children labelled as a bully according to parent, teacher or child report which is consistent with the hypotheses and previous studies (Farooqi et al., 2007; Scott et al., 2012). It is possible that due to their poorer physical and motor development, combined with poorer social skills, they are less able to adopt a dominating role over other children. The next domain, frequency of social interaction was described in Chapter Six. Results showed that EPT born children were less likely to spend time with friends (page 76). This supports previous research which has also found EPT born children to be less likely to engage in team sports and activities

and be more withdrawn from peers than FT born children (Jones et al., 2013; Scott et al., 2012; Farooqi et al., 2007; Reijneveld et al., 2006b). Overall, the social performance findings are of concern as lower levels of prosocial behaviour and less interaction with friends can lead to poorer peer relationships and mental health difficulties in adolescence and early adulthood (Goodwin, Fergusson, & Horwood, 2004; Jose et al., 2012; Markiewicz, Doyle, & Brendgen, 2001).

Next, this chapter examined whether social skill and social performance variables were associated with two social adjustment outcomes: peer relationship problems and victimization. Social skill, social performance, cognitive, behavioural and emotional variables helped account for the differences seen between gestational groups on the peer problems outcome measure. As discussed in Chapter Two it is widely accepted that there is a complex interplay of cognitive, behavioural and emotional factors on the development of social competence. Furthermore, general developmental studies have similarly shown interpersonal skills, socio-cognitive skills, aggressive behaviour and low levels of social interaction to influence the social acceptance and inclusion of preadolescents (Carr, 2006; Bierman & Furman, 1984; Downey, Lebolt, Rincón, & Freitas, 1998; Laible, 2007; Nansel et al., 2001). The social and associated risk factors that explained the group differences between EPT and FT born children (parent and friend attachment, aggressive behaviour, never spending time with friends, math fluency, and hyperactivity/inattention) may help characterise the children who are experiencing peer relationship problems which may aid identification and intervention strategies. Furthermore, the broad range of adverse associated factors that children with peer problems may experience may not only be reducing their current quality of life but also putting them at further risk of a range of negative, short and long-term outcomes such as poorer academic achievement, unemployment, emotional difficulties and difficulties with intimate relationships (Buhs, Ladd & Herald, 2006; Fox & Boulton, 2006; Jose et al., 2012; Kajantie et al., 2008; Woodward & Fergusson, 2000; Zwierzynska, Wolke & Lereya, 2013).

Conversely, however, results suggested that frequent victimization was not associated with poor social skills once physical and mental health and behavioural difficulties were taken into account. Thus, over and above social skills and social performance abilities, significantly associated risk factors of frequent victimization at age 12 years were having a higher BMI, less pubertal development, vision problems and increased levels of hyperactivity/inattention. These risk factors were discussed in Chapter Six (page 82). These results emphasise that dynamic child factors (such as their personal social skills) are less associated with victimization than physical development outcomes, then there is a need for multi-systemic intervention at the school level (such as increasing peer acceptance) as most of these risk factors (such as timing of puberty) cannot be changed directly.

When identifying risk factors for developmental outcomes, the general conclusion from the developmental literature and longitudinal studies is that risk factors such as those highlighted in the current study tend to be additive, where the risk of social difficulties likely accumulates as the number of risk factors increase (Appleyard, Egeland, Dulmen, & Alan Sroufe, 2005; Evans, Li, & Whipple, 2013; Kraemer, Lowe, & Kupfer, 2005; Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987). Therefore, in order to predict individual vulnerability of peer relationship difficulties (and subsequently intervene) the accumulation of risk factors at the individual level must be considered. In other words, a child who presents with math difficulties, hyperactive/inattentive behaviour, and never spends time with friends will be at the highest risk of having peer relationship difficulties. In line with this, a child who has poor vision, is more overweight and has hyperactive/inattentive behaviour will be at increased risk of being frequently victimised than a child who presents with none or one of these factors. EPT born children have been shown to be at higher risk for a range of these difficulties, which may be increasing their risk of these social difficulties (Aarnoudse-Moens, Weisglas-Kuperus, et al., 2009; Johnson et al., 2010; Mansson, Stjernqvist, & Backstrom, 2014; Saigal & Doyle, 2008).

These findings have a number of implications. Firstly, in terms of the assessment of social difficulties, the findings show that EPT born children are also at risk of difficulties in social skill and social performance components, thereby identifying a need to address a range of social competence difficulties in the assessment and treatment of children born EPT. Interventions should also address as many of the risk factors as possible, as even the reduction of one risk factor can make a significant difference in decreasing the risk of adverse social adjustment outcomes (Appleyard et al., 2005). For example, the regulation of hyperactive/inattentive behaviour in children could reduce increased risk of both peer problems and victimization. Teaching parents and teachers to structure the children's environments and being consistent with behavioural management strategies such as positive reinforcement is also an important intervention component which is helpful for children with such difficulties (Carr, 2006; Frederick & Olmi, 1994; Rucklidge, 2008). Finally, another avenue for intervention is in the NICU where there should be an increased effort to reduce adverse neonatal factors linked with later vision, motor, hyperactivity/inattention and social development as described in Chapter Six (Jones et al., 2013; Saigal & Doyle, 2008; Rogers et al., 2012; Spittle et al., 2009b; Taylor et al., 2006).

When considering risk factors in developmental literature it is also important to consider possible resilience factors, which may buffer the negative effect of the risk factors experienced. Future research should endeavour to identify resilience factors that may aid the social development of children born EPT. For example, Treyvaud et al. (2011) found that a more optimal home environment (such as parental involvement, an organised physical environment, having a range of

toys and a variety of daily activities) was associated with better social-emotional competence (including compliance, play and empathy) in children born EPT and VPT. Knowledge of resilience factors as such provides strategies of what parents can do to help their at-risk children. This can provide a sense of control and guidance for parents who can feel stressed and helpless after the birth of an EPT/VPT child as well as positively influence the child's development.

The present study was based on a prospective, longitudinal and representative sample. It is one of the first to comprehensively investigate the social competence of EPT and VPT born children during pre-adolescence and thus provides valuable information as to assessment and intervention targets. Even so, there are some limitations to report. The most pertinent one is that the data used for the analysis of the model was cross-sectional, so we cannot be confident on the causality of some of the associations reported. Future longitudinal research should aim to assess these children at multiple time points with consistent measures in order to more profitably examine the direction of associations and evaluate the developmental cascade of these difficulties. Secondly, it would have been very interesting to gain multiple informant reports on all domains measured in the model. Although not feasible in the current study, future studies should endeavour to make this possible given the differences that were seen across each informant's report. A more comprehensive measure of social skills, especially from direct observation of social contexts in ecologically representative contexts, would also have been beneficial given the large effect of the basic composite measure used in the current study. A final limitation was the low number of EPT born children in the sample meaning the statistical power was reduced. This prevented analyses examining the influence of gender and neonatal medical characteristics on social adjustment outcomes within the EPT sample and also prevented individual analyses for each gestational group which may have identified unique risk factors for the different gestational groups.

In conclusion, EPT born children were shown to have poorer interpersonal skills, lower levels of prosocial behaviour and less interaction with friends. Social skills and social performance variables did associate with having significant peer problems at age 12 years but not as well with frequent victimization. As discussed, there were also a number of child and family factors associated with the social adjustment outcome such as physical, emotional and behavioural difficulties. This highlights the importance of a broad examination of social competence and the inclusion of a wide range of developmental factors. The thesis thus far has provided a comprehensive examination of the social competence of EPT, VPT and FT born children at age 12 years. A longitudinal approach to examining social competence would offer further important information as to the trajectory of these children's peer relationship problems across childhood as well as possible identification of early risk factors. Therefore, the following chapter addresses these issues.

"She likes sport but hasn't been able to keep up with the other children. She doesn't get picked for any sports teams and she only has one friend. She experiences lots of verbal bullying too."

– Parent of female VPT participant (born 28 weeks).

Chapter Eight

The Developmental Trajectory of Social Competence of EPT, VPT and FT born children from Age 4 to 12 Years

As was highlighted in the previous two chapters, children born EPT are more likely to have poor social competence at age 12 years as measured by aspects of their social skills, social performance and social adjustment outcomes. Difficulties they are likely to experience include poorer interpersonal skills and prosocial behaviour, less frequent interaction with friends, fewer friends, less satisfaction with the number of their friends, and increased rates of peer relationship problems and victimisation. Results further show that although VPT born children are spared from most social difficulties, they are also at increased risk of being frequently victimised compared to FT born children at age 12 years.

Consistently, preliminary studies also show EPT/VPT born children to be at increased risk of a range of social competence difficulties. Social difficulties appear by early childhood, as early as three years of age and persist throughout childhood and into early adolescence (Delobel-Ayoub, Kaminski, Marret, Burguet, Marchand, N'Guyen, Matis, Thiriez, Fresson, Arnaud, Poher, Larroque, & Grp, 2006; Ritchie et al., 2015; Yau et al., 2013). Studies most commonly use the SDQ peer problems subscale and most have shown EPT/VPT born children to be at increased risk of peer relationship problems at individual time points (Ritchie, Bora & Woodward, 2015). However, to the best of the author's knowledge, no studies have described the trajectory of peer problems of a single cohort from early childhood through to preadolescence. Therefore, it is not known whether EPT and VPT born children's peer difficulties increase or decrease over time in comparison to FT born children. This information is critical in terms of planning intervention for these high-risk children.

Also important in terms of planning intervention strategies are predictors which may identify children at-risk of social difficulties from an early age. Fortunately, a small number of

studies have sought to identify longitudinal predictors of social competence difficulties. These studies have found social competence to be related to neonatal characteristics such as cerebral white matter injury; early social difficulties; and early family background and parenting factors such as SES, home environment and maternal mental health (Charkaluk et al., 2010; Jones et al., 2013; Spittle et al., 2009; Taylor et al., 2006; Treyvaud et al., 2012). However, no studies have examined early child and family factors that may place children at risk of peer problems that are present in pre-adolescence.

Developmental literature from the general population shows that cognitive skills, verbal skills, emotional regulation skills, and intelligence can all influence social development (Carr, 2006; Hops & Finch, 1985; Raino, 2008; Rose-Krasnor, 1997; Semrud-Clikeman, 2007). Family functioning variables such as parenting style, family instability, sibling relationships and maternal mental health have also been shown to be related to children's social competence (Bronfenbrenner & Morris, 1998; Campbell, Lamb & Hwang, 2010; Carr, 2006; Engels, Finkenauer, Meeus & Devokic, 2001; Rubin et al., 2009). Investigating the trajectory of peer relationship difficulties over time, as well as identifying risk factors for the preterm population will increase the knowledge of critical time periods of social development and allow us to identify who may be prone to poorer social trajectory over time as well as inform and develop intervention strategies.

Therefore, the current research aims were to 1) examine longitudinally the development of peer relationship problems in children born EPT and VPT in comparison to FT born children at age 4, 6, 9 and 12 years and 2) to longitudinally identify a wider range of risk factors at age 4 years (such as maternal mental health, parenting style, family instability, child emotional regulation skills etc.) that may predict poor peer relationships at age 12 years.

8.1 Method

8.1.1 Sample. The sample selection process and the sample characteristics have been described previously (pages 52 - 56, Chapter Five).Within the current study, of the 213 children who participated in the 12-year follow up study, there were 42 EPT born children, 54 VPT born children, and 103 FT born children who had complete parent data at all four time points (ages 4, 6, 9, and 12 years; n=199). Thus, 95%, 90% and 94% of the 12-year sample for each group had full parent report data, respectively. There were 36 (82%) EPT born children, 47 (78%) VPT born children, and 96 (88%) FT born children who had complete teacher data at all four time points (n=179). There were no statistically significant differences between children without complete data and those who had complete data, in terms of neonatal clinical and social background characteristics ($p > .05$).

8.1.2 Procedure. As part of the 2, 4, 6, 9 and 12-year follow-up, children and their families were seen within two weeks either side of their birthday (corrected for the extent of prematurity at all ages except the 9 year follow-up). Parents and teachers were questioned about the child's relationships with peers. At age 4 years children completed a neurodevelopmental assessment. A fuller description of the methods used in the study is provided in Chapter Five (pages 56 - 60).

8.1.3 Measures.

Peer problems. Peer problems at ages 4, 6, 9 and 12 years were assessed by parent and teacher report using the peer problem subscale of the SDQ described in Chapter Six (pages 70 and 73). Although research suggests that combined parent and teacher report provide the most reliable results, parent and teacher report were kept separate for this chapter due to the amount of missing teacher data. Teacher data was analysed however, in order to support (or not) the findings from parent report. A 12-year peer problems summary variable was created for use in the logistic regression analyses and was described previously (page 73 and 74).

Associated risk factors used in the regression analysis. *A priori* theoretical knowledge and correlation coefficients were used to determine the variables included in the regression analysis. Three distinct areas were hypothesized to influence the children's social adjustment outcomes. These were 1) baseline characteristics, 2) early family related factors (such as parenting and maternal mental health) and 3) 4 year child characteristics (such as child IQ and emotional regulation skills). The variables that were entered into the regression analyses are described below.

Baseline characteristics. Family SES, sex and birth status were entered in this block. Family SES has been described previously (page 72).

Early family-related factors. Family instability: During the 2 and 4 year follow-up assessment, parents were asked "How many parental changes had there been in the household?" The number of changes in the household between birth and age 4 years was summed.

Parenting behaviour at age 2 and 4 years. Parenting behaviour was measured at age 2 and 4 years by independent blind raters observing parent-child dyads completing three problem-solving tasks. These measures have been described in detail in previous publications from this longitudinal study (Jones et al., 2013; Clark, Woodward, Horwood, & Moor, 2008b). Three aspects of parenting behaviour were measured: supportiveness, intrusiveness and parent-child synchrony. *Parental supportive presence* measured behaviours such as leaning in towards their child when they were having more difficulty, and providing assistance and encouragement. *Parental intrusiveness* measured controlling behaviour such as using an authoritarian instructing style, and interfering or taking over the child's task. *Parent-child interactional synchrony* measured joint behaviour such as eye contact, shared affect, and responsiveness to each other. Scores from each follow-up assessment were

averaged to form a composite measure averaged across ages 2 and 4 years. The psychometric properties of the measures were satisfactory (inter-rater reliabilities = .84, .68 and .83, respectively; Clark et al., 2008b; Jones et al., 2013).

Maternal mental health. Levels of maternal anxiety and depression were measured at the 2 and 4 year follow-up using the self-report Hospital Anxiety and Depression rating scale (HADS; Zigmond & Snaith, 1983). This 14 item questionnaire contains seven items relating to anxiety and seven items relating to depressive symptoms that the mother may have experienced over the prior two weeks. Examples include "I feel tense and wound up" (anxiety) and "I feel alone and without friends" (depression). Answers were rated on a four point Likert scale: 0 = Not at all; 1 = Occasionally; 2 = Quite often; 3 = Most of the time. This scale is widely used in epidemiological research and has adequate psychometric properties with Cronbach's alpha coefficients of .80 (anxiety) and .78 (depression; Herrmann, 1997; Mykletun, Stordal, & Dahl, 2001). This measure was also shown to have internal reliability with the anxiety scale producing Cronbach alpha coefficients of 0.72 at age 2 years and 0.75 at age 4 years. Similarly, the depression subscale showed Cronbach alpha coefficients of 0.68 at age 2 years and 0.76 at age 4 years.

Four year child characteristics. *Child intellectual ability:* During the 4 year follow-up assessment children's intellectual ability was assessed using the revised version of the Wechsler Preschool and Primary Scales of Intelligence (WPPSI-R; Wechsler, 1989). The WPPSI-R is a standardised measure which has been extensively used in the preterm and general literature to assess cognitive ability in children aged 3 to 7 years. A WPPSI-R short-form was used to estimate full-scale IQ using the Comprehension and Arithmetic subtests of the Verbal scale and the Picture Completion and Block Design subtests of the Performance scale (Kaufman, 1972; Sattler, 2008). This short form is intended to only generate an estimated Full Scale IQ score for use in research or as a general screening tool (Kaufman, 1972). Sattler (2008) suggests that despite the short-form lacking specificity the subtests provide a good measure of general intelligence. The Comprehension and Arithmetic subtests and the Picture Completion and Block Design subtests have a high correlation with Verbal IQ and Performance IQ (0.86 and 0.84 respectively; LoBello, 1991) and correlates highly with Full-Scale IQ scores (0.90; LoBello, 1991). Finally, the four Cronbach alpha scores for the subtests are between 0.80 and 0.85 (Sattler, 2008).

Emotional regulation. A composite variable designed to measure the level of emotional regulation in the cohort children at age 4 years was developed for and described in previous research from this longitudinal study (Jones et al., 2013). The composite variable was created by summing the scores, based on parent report, from the Emotional Regulation Checklist, Emotional Regulation Subscale (Shields & Cicchetti, 1997); the Self-Regulation Problems Subscale from the

Infant Toddler Symptom Checklist (DeGangi, 1995; DeGangi, Breinbauer, Roosevelt, Porges, & Greenspan, 2000); and the Emotional Control Problems Subscale from the Behaviour Rating Inventory of Executive Function – Preschool version scale (BRIEF-P; Gioia, Espy, & Isquith, 2005). This composite was shown to have adequate psychometric properties with this cohort at age 4 years (Cronbach's alpha = .82; Jones, Champion & Woodward, 2013).

Behavioural inhibition. Behavioural inhibition at age 4 years was assessed using the Inhibitory Control Subscale from the BRIEF-P using parent report (Gioia et al., 2005). The BRIEF-P is designed for use in children aged 3-5.11 years of age. This subscale is designed to measure ability to inhibit behavioural responses on a 16 item 3 point Likert scale (1 = Rarely/Never to 3 = Often). The psychometric properties for this subscale in this cohort at age 4 years were good and in line with previous research (Cronbach's alpha = .80-.90; Isquith, Crawford, Espy, & Gioia, 2005).

Language delay. The preschool version of the Clinical Evaluation of Language Fundamentals – Preschool Version (CELF-P) was used to assess language ability (Wiig, Secord, & Semel, 2004). The scoring of this scale has been described previously (Pritchard et al., 2014). However, in short, each child's overall language ability score was dichotomized with those scoring one standard deviation below the mean of the FT group being classified as language delayed. This dichotomous score was used in the regression analyses. Cronbach's alpha for the subscales in this cohort were between 0.81 and 0.88 (Foster-Cohen, Friesen, Champion, & Woodward, 2010).

Emotional and behavioural development. The SDQ was also completed by parents and teachers at age 4 years in order to measure the emotional and behavioural development of the children (described in more detail on pages 70 and 73). However, there were 15 cases missing for teacher report data, so in order to retain statistical power, only the parent report at age 4 years was included in the current study for the hyperactivity/inattention, emotional difficulties, conduct problems, and prosocial behaviour subscales.

8.1.4 Data analysis. Data analysis occurred in two stages. Firstly, the developmental trajectory of peer problems was examined using the parent report data as the main dependent variable (analyses were re-run using teacher report data to corroborate the parent report findings). A 3 (Group: EPT, VPT, FT) x 4 (Time: 4, 6, 9, 12-year follow-up) repeated measures ANOVA was conducted to examine between-group differences over time and to assess interaction effects between Group and Time. Significant effects (i.e., Group, Group x Time) were followed up by: a) univariate ANOVAs at each time point to examine at which ages there were differences between groups (using Gabriel's procedure and the Games-Howell procedure for post-hoc analyses as explained in Chapter Six, page 74), and b) repeated measures ANOVAs for each gestational group separately to examine the nature of each group's trajectory over time using polynomial contrasts.

A repeated measures analysis approach was used in the current thesis (as opposed to other analyses such as latent growth curve modelling) because I was mainly interested in group-level averages of change, and because the parent report data set had very few missing data.

Secondly, to examine predictors at age 2 and 4 years of peer relationship difficulties at age 12 years, a set of potential longitudinal child and family factors from ages 2 and 4 years associated with children's peer relationships were identified using bivariate correlations with continuous 12-year peer relationship problem outcomes (SDQ Peer Problems Subscale and the Peer Connectedness Scale described on pages 70 and 71). If variables were highly correlated (< .50), only the variable which was most associated with the peer relationship outcome variables was included to avoid problems with multi-collinearity and singularity.

Next, binary logistic regression modelling was used to determine the risk factors for children's increased risk of peer relationship difficulties at age 12 years using the summary variable described earlier (pages 73 and 74). Due to the low sample size of EPT born children, all three groups were pooled and birth status was entered as one categorical predictor into the regression model where EPT birth status = 1, VPT birth status = 2 and FT birth status = 3. Within the regression, EPT and VPT groups were then compared against the FT group which was the reference category. Results are displayed for each comparison (EPT vs FT and VPT vs FT) in separate rows of result tables. Variables were entered into the regression equation in 3 distinct blocks namely, Block 1) baseline characteristics, Block 2) Early family-related factors, and Block 3) 4 year child characteristics. Model fitting was performed using both forwards and backwards variable selection to identify the most parsimonious model, with a $p < .05$ criterion used to retain variables.

8.2 Results

8.2.1 Developmental trajectory of peer problems. Figure 8.1 shows the trajectory of peer problems for each gestational group across the four follow-up ages according to parent report. Means and standard deviations are presented in Table 8.1. The 3 (Group) x 4 (Time) repeated measures ANOVA using parent report as the dependent variable revealed a statistically significant between-group difference across all time points [Group: $F(2 , 196) = 12.66$, $p < .001$, $\eta_p^2 = .11$], as well as a statistically significant effect for changes over time [Time: $F(3,194) = 3.89$, $p = .01$, $\eta_p^2 = .06$]. Finally, there was a statistically significant interaction between the degree of peer problems over time and gestational group (Group x Time) suggesting that the trajectory for each group differed [Pillai's Trace = .07; $F(6, 390) = 2.18$, $p = .04$].

As there was a significant Group effect, univariate ANOVA's were run at each time point in order to identify at which ages the gestational groups differed. Table 8.1 shows that there were statistically significant differences between the gestational groups at 4, 6, 9 and 12 years according to parents. Post-hoc tests revealed that statistically significant differences already existed between the EPT born children and the VPT and FT born children at age 4 ($p = .002$, $p < .001$, respectively; both Cohen's $d = 0.6$). At age 6 years, only the EPT vs FT between-group comparison reached statistical significance ($p < .001$, Cohens $d = 0.7$). At age 9 years, after taking into account the unequal variances between groups using Games-Howell post-hoc tests, the difference was no longer statistically significant ($p = .06$) and the effect size was small (Cohen's $d = 0.4$). Finally, at age 12 years EPT born children remained at increased risk of peer problems in comparison to VPT and FT born children (both $p < .001$; both Cohen's $d = 0.8$). Examination of effect sizes at each follow-up age show increasing effect sizes from moderate effect sizes at age 4 years through to large effect sizes at age 12 years for parents (except at age 9 years where only small effect sizes were found). There were no statistically significant differences between VPT and FT born children at any age. All between-group differences remained statistically significant after adjustment for SES and maternal education.

Due to the significant interaction between Group and Time for parent report, repeated measures analyses were re-run for each gestational group separately in order to assess the nature of each group's trajectory. Within-subject effects for Time, tests of within-subjects contrasts, effect sizes and observed power are displayed in Table 8.2. Table 8.2 shows that there were no statistically significant changes over time for EPT and VPT children ($p = .22$, and $p = .07$, respectively). Inspection of the effect sizes, however, shows that for the EPT born children there was a moderate effect size for the linear contrast ($\eta_p^2 = .06$) suggesting a positive linear trend over time. This may mean that over time EPT born children's peer relationship difficulties increase (see Figure 8.1), but as a result of the low sample size (and thus lack of statistical power), these statistics must be interpreted cautiously and need replication and confirmation. There was a moderate effect size ($\eta_p^2 = .09$) for a quadratic trajectory for the VPT born children suggesting that their peer relationship problems initially increased over time but then decreased again by age 12 years(see Figure 8.1), but again lacked statistical power. Finally, for the FT born children there was a cubic relationship over time with a large effect size ($p < .001$, $\eta_p^2 = .15$). This is supported visually in Figure 8.1 where levels of peer relationship difficulties decrease from age 4 to age 6 years, then increasing again at age 9 years before a decline in peer relationship problems at age 12 years.

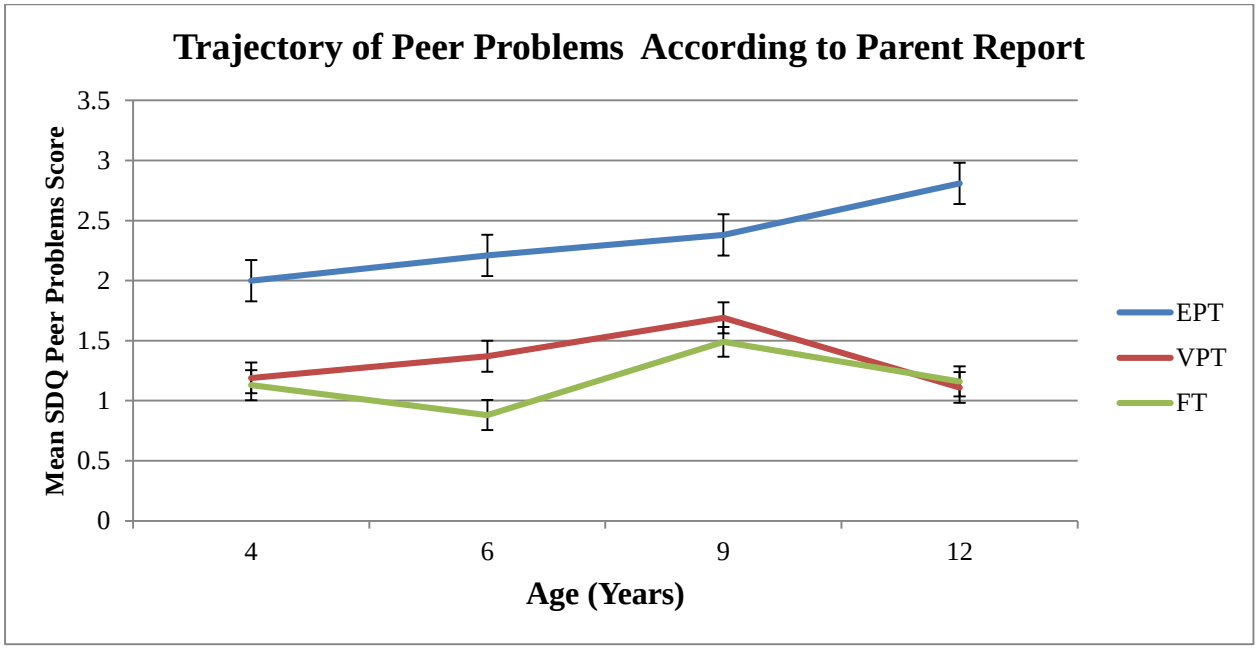

Figure 8.1: Trajectory of Peer Problems for each Gestational Group from ages 4 to 12 years according to parent report.

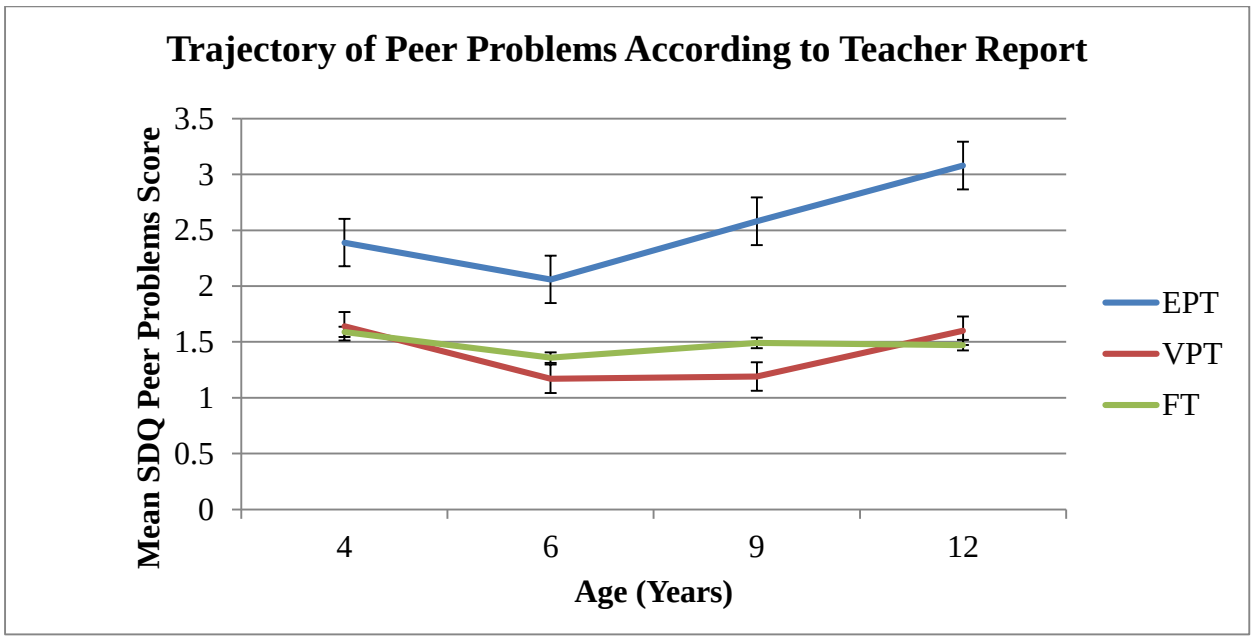

Figure 8.2: Trajectory of Peer Problems for each Gestational Group from ages 4 to 12 years according to teacher report.

Table 8.1: Means and Standard Deviations of Peer Problems According to Parent and Teacher Report for Each Group at each Follow-up Age and Results of Univariate ANOVA's

Child age and informant	EPT M(SD)	VPT M(SD)	FT M(SD)	*F*	*p*-values				
					*Overall^*	EPT vs VPT	EPT vs FT	VPT vs FT	η_p^2
Age 4									
Parent	2.28 (2.06)	1.19 (1.32)	1.16 (1.45)	8.62	<.001[a]	.002 [a]	.000 [a]	.99	.08
Teacher	2.43 (2.14)	1.57 (1.87)	1.75 (1.94)	2.42	.09	.11	.16	.93	.02
Age 6									
Parent	2.19 (2.29)	1.39 (1.67)	0.89 (1.36)	9.37	<.001[a]	.06	.000 [a]	.18	.09
Teacher	2.03 (2.19)	1.20 (1.68)	1.37 (1.77)	2.57	.08	.09	.14	.92	.03
Age 9									
Parent	2.43 (2.29)	1.61 (1.77)	1.54 (1.68)	3.82	.02	.08	.06*	1.0	.04
Teacher	2.55 (2.37)	1.28 (1.35)	1.52 (1.82)	6.19	.002[a]	.003 [a]	.007 [a]	.82	.06
Age 12									
Parent	2.84 (2.50)	1.20 (1.35)	1.20 (1.54)	15.57	<.001[a]	.000 [a]	.000 [a]	.82	.13
Teacher	3.19 (2.63)	1.73 (1.60)	1.51 (1.96)	10.79	<.001[a]	.001 [a]	.000 [a]	.88	.10

Note: EPT: Extremely Preterm; VPT: Very Preterm; FT: Full-Term, M: Mean, SD: Standard Deviation, ^ P-value for univariate ANOVA between-group comparison for all three groups; [a] remained statistically significant after adjustment for socio-economic status and maternal education. *Post-hoc tests presented are based on Gabriel's procedure except for the 9 year parent report for which Games-Howell is provided. η_p^2 > 0.01 considered small, >0.06 considered medium, and >0.14 considered large effects.

The analyses were re-run using the teacher report data. Given the reduced sample size due to missing teacher reports, these data were only used to corroborate the findings from the parent data. Figure 8.2 shows the trajectory of peer problems for each gestational group across the four follow-up ages according to teacher report. Means and standard deviations are presented in Table 8.1. The 3 (Group) x 4 (Time) repeated measures ANOVA using teacher report as the dependent variable revealed a statistically significant between-group difference across all time points [Group: F (2, 176) = 8.32, $p < .001$, $p\eta^2 = .09$], as well as a statistically significant effect for changes over time [Time: $F(3,174) = 3.51$, $p = .02$ $p\eta^2 = .06$]. However, there was no statistically significant interaction between the degree of peer problems over time and gestational group (Group x Time) [Pillai's Trace = .04; F (6, 350) = 1.16, $p = .33$].

As there was a significant Group effect, univariate ANOVA's were run for each follow-up age in order to identify at which ages the gestational groups differed. Table 8.1 shows that there were statistically significant differences between the gestational groups at 9 and 12 years according to teachers. Post-hoc tests revealed that statistically significant differences existed between the EPT born children and the VPT and FT born children at age 9 years, ($p = .003$ and .007; Cohen's $d = 0.6$ and 0.5, respectively) and at age 12 years (both $p < .001$; both Cohen's $d = 0.7$). Effect sizes were moderate. There were no statistically significant differences between VPT and FT born children at any age. All between-group differences remained statistically significant after adjustment for SES and maternal education

For the sake of consistency, repeated measures ANOVA's were re-run using teacher report data for each gestational group separately in order to assess the nature of each group's trajectory. Table 8.2 shows that results were consistent with parent report (see also Figure 8.1 and 8.2). For example, although there were no statistically significant changes over time for EPT, VPT or FT born children (p = .12, p = .24, and p=.26, respectively), there was a moderate effect size suggesting a positive linear trend for EPT born children over time (p = .09, η_p^2 = .08). Results for the VPT born children were in line with the parent report where there was no statistically significant change over time, but a quadratic trajectory with a moderate effect size was identified (p = .05, η_p^2 = .08). In contrast to parent report, there was no significant trajectory for the FT born children.

Table 8.2: Within-Subject Effect for Time and Contrasts Over Time for Each Group Analysed Separately, According to Parent and Teacher Report.

			F	*p*	η_p^2	Observed power
Parent report						
EPT	Time		1.52	.22	.04	.33
	Contrasts	Linear	2.50	.12	.06*	.34
		Quadratic	1.16	.29	.03	.18
		Cubic	0.01	.93	.00	.05
VPT	Time		2.42	.07	.04	.60
	Contrasts	Linear	0.02	.91	.00	.05
		Quadratic	5.19	.03	.09*	.61
		Cubic	2.24	.14	.04	.31
FT	Time		6.16	<.001	.06*	.96
	Contrasts	Linear	1.93	.17	.02	.28
		Quadratic	0.21	.65	.00	.07
		Cubic	17.93	<.001	.15**	.99
Teacher report						
EPT[a]	Time		2.07	.12	.06*	.48
	Contrasts	Linear	3.03	.09	.08*	.39
		Quadratic	1.51	.23	.04	.22
		Cubic	0.97	.33	.03	.16
VPT	Time		1.40	.24	.03	.37
	Contrasts	Linear	0.01	.92	.00	.05
		Quadratic	3.98	.05	.08*	.50
		Cubic	0.02	.89	.00	.05
FT	Time		1.36	.26	.01	.36
	Contrasts	Linear	1.23	.27	.01	.20
		Quadratic	2.01	.16	.02	.29
		Cubic	0.97	.33	.01	.16

Note: EPT: Extremely Preterm; VPT: Very Preterm; FT: Full-Term. η_p^2 > 0.01 considered small, >0.06 considered medium (*), and >0.14 considered large (**) effects. . [a] Hunyh-Feldt corrections were used due to violation of sphericity (Field, 2013).

8.2.2 Predictors at age 4 years of peer relationship difficulties at age 12 years. Next, the current study sought to examine early childhood predictors of peer relationship problems at age 12 years. Table 8.3 shows the bivariate correlations between a range of child and family variables from birth (rows/columns 1, 2, 5) and age 4 years (rows/columns 6-21) and children's peer relationship problems at age 12 years (rows/columns 3 and 4). Based on *a priori* information, statistical significance and strength of the correlation coefficients (>.30), risk factors from age 4 years associated with peer relationship difficulties at age 12 years were identified.

Although many small associations existed between 4 year variables and social adjustment outcomes (peer connectedness and peer problems) at age 12 years, ones of moderate association were of significant interest (coefficients >.30). The peer problems outcome variables had moderate correlations with 4 year: emotional regulation; peer problems; hyperactivity/inattention; conduct problems; child IQ; and language delay. To avoid problems with multi-collinearity, conduct problems and language delay were excluded from the regression model as they correlated highly with hyperactivity/inattention and child IQ (respectively) and hyperactivity/inattention and child IQ had larger associations with peer problem outcomes at age 12 years. Background and parenting variables were theoretically important to include in the regression model. After taking into account the strength of the associations with outcome variables (>.30) and multi-collinearity of predictor variables, variables chosen to be regressed onto the peer relationship difficulties at age 12 years in the following blocks. Block 1: Baseline Characteristics included birth status, sex, family SES. Block 2: Early Family-Related Characteristics included intrusive parenting score, synchronous parenting score, and maternal depression. Block 3: 4 year child characteristics included emotional regulation score, hyperactivity/inattention score, peer problems score, and child IQ score. Variables that made an independent net contribution to the prediction of peer relationship problems and frequent victimization are shown in Table 8.4.

Results showed that lower IQ scores and higher hyperactivity/inattention at age 4 years were associated with having peer relationship difficulties at age 12 years. For every unit score higher on the child IQ scale children were at 1.04 times lower odds of having peer problems at age 12 years (OR = 0.96, 95% CI = 1.01, 1.06, p = .002). For every unit score higher on the hyperactivity/inattention scale at age 4 years children were at 1.2 times higher odds of having significant peer problems at age 12 years (*OR* = 1.21, 95% CI = 1.04, 1.40, p = .01). These results have relatively small practical significance for small changes in IQ and hyperactivity scores, however those with very low cognitive ability (every 20 points lower on the scale) and/or high levels of hyperactivity/inattention (every 5 points higher) will be at two times higher odds of having peer

Table 8.3 Bivariate Correlations Between Child and Family Factors at Age 4 Years and 12 Year Peer Problem Outcomes.

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Birth Status	**-.19**	.01	**-.29**	-.06	-.12	-.01	-.12	.11	-.09	**.17**	**-.14**	**.21**	**.22**	**-.19**	**-.33**	**-.20**	**-.19**	**-.24**	.11	**-.16**	-.09
2. Socio-Economic Status (age 2 years)		.07	**.16**	.06	**.27**	.12	.12	-.04	.06	-.05	.10	-.03	**-.16**	**.20**	**.20**	.12	**.21**	**.17**	**-.20**	.04	**.26**
3. Peer Connectedness			**-.35**	.06	.05	.00	-.04	-.03	.03	.04	-.01	.08	.06	-.02	**-.17**	-.09	-.03	-.14	**.17**	-.08	-.12
4. Peer Problems Combined Report Age 12 Years				-.09	**.22**	**.23**	**.15**	-.04	.07	**-.14**	**.19**	**-.26**	**-.39**	**.28**	**.42**	**.34**	**.38**	**.36**	**-.22**	.10	**.35**
5. Sex*					.11	-.11	-.06	-.05	-.09	.07	**-.17**	.07	**.15**	-.05	-.11	**-.18**	.02	**-.27**	.12	.07	-.01
6. Number of changes in parent (ages 0-4 years)						.06	.02	.02	.09	-.01	.06	-.00	-.03	.14	**-.18**	.04	.07	.05	-.12	.04	**.18**
7. Average Maternal Depression							**.52**	-.04	.10	-.11	.08	-.13	**-.21**	**.29**	**-.26**	**.15**	.12	**.16**	**-.18**	.04	**.23**
8. Average Maternal Anxiety								-.04	.12	-.06	.13	-.13	**-.15**	**.35**	**.16**	.10	.05	**.20**	**-.15**	.10	**.20**
9. Early Positive Parenting									**.23**	**.75**	.11	**.76**	.04	-.12	**.19**	**-.18**	-.00	.00	.00	.01	-.07
10. Negative Parenting										**.22**	**.56**	**.21**	**-.14**	.09	-.14	**.14**	.04	.12	.00	-.02	.10
11. Early supportive parenting											.04	**.79**	**.24**	**-.20**	**.24**	**-.21**	-.09	**-.15**	.12	-.10	-.13
12. Early Intrusive Parenting												.02	**-.33**	**.21**	**-.29**	**.32**	.08	**.26**	-.13	.02	**.17**
13. Early Synchronous Parent Interactions													**.19**	**-.16**	**.31**	**-.35**	**-.14**	-.14	.15	-.11	-.13
14. Emotional Regulation (4yrs)														**-.24**	**.49**	**-.48**	-.13	**-.44**	**.25**	-.10	**-.38**
15. Inhibition (age 4 years)															**-.29**	**.16**	.12	**.53**	**-.24**	.13	**.55**
16. WPPSI Estimated Full Scale IQ (4 year)																**-.57**	**-.14**	**-.36**	**.17**	-.08	**-.28**
17. Language Delay (4 years)*																	**.25**	**.36**	**-.23**	.02	.13
18. Peer Problems (4 year)																		**.16**	**-.25**	**.36**	.11
19. Hyperactivity/Inattention (4 year)																			**-.42**	.11	**.57**
20. Prosocial (4 year)																				**-.14**	**-.43**
21. Emotional Difficulties (4 year)																					.09
22. Conduct Problems (4 year)																					

Note: Dichotomous variables denoted by *. Statistically significant associations signified by bold text (where $p<.05$).

Table 8.4: Final Fitted Regression Models for Child and Family Characteristics at Age 4 Years Associated With Peer Relationship Problems at Age 12 Years.

	Block 1 Baseline Characteristics at Birth			Final Block 4 year Child Characteristics		
	B (SE)	*Exp (B)*	*p*	*B* (SE)	*Exp (B)*	*p*
EPT Birth Status	1.34 (.39)	3.83	.001	0.80 (.43)	2.23	.07
VPT Birth Status	0.05 (.40)	1.05	.90	-0.47 (.44)	0.63	.29
Child IQ				-0.04 (.01)	0.96	.002
Hyperactivity/Inattention				0.19 (.07)	1.21	.01

Note: B: Standardised Beta; SE: Standard Error; *Exp (B)*: Odd Ratio; EPT: Extremely Preterm group compared to FT group as reference category; VPT: Very Preterm group compared to FT group as reference category.

problems than those with normal cognitive ability and hyperactivity/inattention levels. No parenting or family background variables were associated with peer problems at age 12 years. This final model was statistically significant [X^2 (4, n = 201) = 37.98, p < .001] and explained between 18% (Cox and Snell R^2) and 25% (Nagelkerke R^2) of the variance in the children's risk of peer relationship difficulties at age 12 years. EPT birth status was no longer statistically significant in this model although still had a moderate effect size (OR = 2.23, 95% CI = 0.95, 5.19, p = .07).

8.3 Discussion

Thus far, this thesis has demonstrated that EPT born children are at increased risk of social competence difficulties compared to VPT and FT born children. However, little has been studied about the trajectory of these social difficulties over time. Therefore, this chapter aimed to extend previous research by examining the development of peer problems in children born EPT and VPT in comparison to FT born children at age 4, 6, 9 and 12 years. Secondly, the current study aimed to longitudinally identify risk factors at age 4 years that may predict poor peer relationships at age 12 years in order to aid assessment and intervention strategies for these high-risk children. This section will discuss the results and implications of the findings. Although limitations related to the overall thesis will be included in the final chapter, limitations pertinent to this chapter will be included in this section.

The current study first described the trajectory of peer problems for each gestational group from age 4 years (early childhood) through to age 12 years (pre-adolescence). EPT born children had higher levels of peer problems from early childhood through to pre-adolescence in comparison to VPT and FT born children. Teacher report, although lacking in statistical power because of loss of data, showed a similar trajectory over time for the three groups of children, adding confirmatory strength to the results from parent report. These findings are in line with previous research that has demonstrated stable social-emotional difficulties in early childhood (Treyvaud, Doyle, et al., 2012) and support the results highlighted in the systematic review in Chapter Three, in that EPT

born children are at increased risk of peer problems which span from infancy or early childhood through to adolescence (Ritchie et al., 2015). Importantly, the current study also found that the effect size attributable to degree of prematurity in birth status increases over time according to both parent and teacher informants. Therefore as these children grow-up the difference in level of peer problems for EPT, VPT and FT born peers becomes more notable. There are a number of reasons why this effect may occur.

Firstly, as discussed in Chapter Two, it is likely there is a cascade effect on the development of social competence. This means that the attainment of a social skill or ability at a younger age likely amplifies their ability to gain further social skills at later ages. Conversely, if a child misses out on developing social skills at a younger age, they are likely unable to develop their social skills further, while other children who have succeeded in developing social skills continue to build upon their skills as they age. This results in two groups of children, one group who do not improve over time (or even worsens) and another group who continue to learn and develop their skills and thus avoid social difficulties. For example, children who experience peer problems have also been found to be more withdrawn and isolated which may reduce the number of opportunities these children have to improve their ability to engage with peers, learn social skills and make quality friendships (Perren & Alsaker, 2006; Rubin et al., 2009; Rubin, Wojslawowicz, Rose-Krasnor, Booth-LaForce, & Burgess, 2006). These two differing trajectories were shown for the EPT and the VPT/FT born children. Therefore, it may be that these cyclic mechanisms amplify the effects of the EPT born children's initial peer relationship difficulties over time (Carr, 2006; Ladd, 2005). These are theoretically and practically of great importance for child development and intervention strategies and future research should also aim to identify these.

Secondly, as friendships and relationship dynamics with peers become more complex as the children age, it may be that EPT born children who are most at risk of low cognitive ability, and poor executive functioning struggle to keep up cognitively with the social tasks required of them (Arnold & Lindner-Muller, 2012; Carr, 2006; Raino, 2008; Stump, Ratliff, Wu & Hawley, 2009). The neurodevelopmental delays more often experienced by EPT born children than their FT counterparts, may result in EPT born children lagging behind their FT peers at an increasing rate as they age. In other words, the delayed cognitive development more often seen in EPT born children may be impacting their ability to engage with friends

Furthermore, at age 12 years is there is an increased appreciation of athleticism and sport engagement, which becomes particularly evident for males. Sport activities begin to create the basis of many social activities with friends and peers during pre-adolescence (Carr, 2006; Evans & Roberts, 1987; Ladd, 2005). Given that EPT born children are at risk of having poorer motor

ability (Foulder-Hughes & Cooke, 2003) and have been shown to be less likely to engage in team and sport related activities (Farooqi et al., 2007; Vederhus, Markestad, Eide, Graue, & Halvorsen, 2010b) it may be that this is creating a divide between EPT born children and their VPT and FT born counterparts. This may occur as EPT born children withdraw from sport activities, or try to engage unsuccessfully (Farooqi et al., 2006; Nadeau et al., 2004). This also proposes the idea that team sport participation may also serve as an additional intervention context. The first aim of such an intervention would be to increase their motor and play skills. Secondly, however, engagement in team sport requires children to follow rules, come together and accept each other at the same time as sharing experiences and emotions which could be invaluable experiences that may enhance their social skills, social performance and overall social adjustment.

The stable, if not increasing, trajectory described in the results is of concern as these children remain at high risk of social problems immediately prior to adolescence and high-school entry where academic, emotional and social expectations increase (Schiller, 1999; Seidman, Allen, Aber, Mitchell, & Feinman, 1994). Poor social competence has been shown to adversely impact academic abilities. For example, a longitudinal study conducted with a New Zealand sample demonstrated that children aged 9 years with peer relationship difficulties had poorer educational achievement at age 18 years (Woodward & Fergusson, 2000). Mental health and emotional difficulties have also found to stem from unsatisfactory social experiences (Jose et al., 2012; La Greca & Harrison, 2005). Longer-term effects that have been implicated include unemployment and difficulties with intimate relationships (Kajantie et al., 2008; Woodward & Fergusson, 2000). The results from the current study show the importance of early intervention in reducing the prolonged social suffering that the EPT born children are more likely to endure throughout childhood.

In order to aid such early intervention efforts, the current study secondly sought to identify predictors at age 4 years which may predict poor peer relationships at age 12 years. Results showed that low cognitive ability and higher levels of inattention/hyperactivity at age 4 years were associated with having peer problems at age 12 years. Consistent with these findings, three out of five studies included in the systematic review in Chapter Three found significant differences on their social competence measures to disappear after controlling for child cognitive status (Ritchie et al., 2015). Furthermore, children with low cognitive ability in the general population are considered to be at risk of social difficulties (Cavell, 1990; Green, Forehand, Beck, & Vosk, 1980). It is considered that low cognitive ability leads to impaired social skills and poor social performance (such as poor prosocial behaviour) which then can lead to social withdrawal and impaired peer

relationships (Bellanti & Bierman, 2000; Kopp, Baker, & Brown, 1992) consistent with findings found in the current study.

Additionally, hyperactivity/inattention difficulties have also been shown to be associated with an increased difficulty with friendships and peer relationships. For example, children with attention deficit hyperactivity disorder (ADHD) are more likely to be rejected, be less well-liked, and have fewer friendships than children without ADHD (Hoza et al., 2005; Hoza, 2007). Symptoms of ADHD such as inattention may restrict children with ADHD from learning their own social skills and/or prevent them from attuning to others social cues (Hoza, 2007). Impulsivity can also be over-bearing in social situations which often annoys peers without ADHD (Hoza, 2007; Mash & Barkley, 2014; Gentschel & McLaughlin, 2000). Research from the general literature has shown that both low cognitive ability and hyperactivity/inattention contribute independent and unique variance to impaired peer relationships in early childhood, with a larger effect from inattention difficulties (Bellanti & Bierman, 2000). Furthermore, EPT and VPT born children have been shown to have both poorer lower cognitive ability, and higher levels of hyperactivity/inattention/ADHD (Aarnadouse-Moens et al., 2009; Barre, Morgan, Doyle & Anderson, 2011; Johnson et al., 2010b; Mansson, Sternqvist, & Backstrom, 2014; Sansavini et al., 2010; Wolke et al., 2008). As such, in the current study, cognitive ability and hyperactivity/inattention scores were associated with peer problems over and above the effects of prematurity. This provides opportunity to target intervention towards children with these developmental difficulties.

However, despite these significant findings, cognitive ability and hyperactivity/ inattention did not explain a large amount of variance in the outcome of those who had peer problems at age 12 years. As discussed, previous studies have also identified neonatal characteristics such as intraventricular haemorrhage, cerebral white matter abnormalities, postnatal corticosteroid use, and bronchopulmonary dysplasia to be related to the development of peer problems (Jones et al., 2013; Spittle et al., 2009b; Taylor et al., 2006; Vederhus et al., 2010b). Future research should investigate the impact of these neonatal characteristics on social outcomes which may be mediated and/or moderated by cognitive ability and hyperactivity/inattention. For example, Bora et al. (2014) found reduced cerebral growth in EPT/VPT born children lead to increased rates of hyperactivity/inattention in childhood. This hyperactivity/inattention then may impact social development. Additionally, Rogers et al. (2012) have also identified brain areas (such as the hippocampus) which were associated with hyperactivity/inattention, as well as peer problems and prosocial behaviour. These results suggest that brain abnormalities may lead to social difficulties through their influence in the development of hyperactivity/inattention problems.

Despite hypotheses favouring the influence of early childhood experiences of parenting styles, parental mental health and peer problems on social adjustment outcome at age 12 years, none of these factors were significantly associated with long-term social outcomes. Previous studies have found parenting and maternal mental health to be associated with children's social development at temporally closer time points. For example, Jones et al (2013) found that increased levels of negative parenting and maternal anxiety related to social difficulties at age 4 years in children born VPT and therefore may remain significant predictors of concurrent social problems in early childhood. Another study, however, did not find an association between parental mental health and socio-emotional competence in very early childhood (age 2 years; Treyvaud et al., 2010). Additionally, SES has also been indicated in preterm literature to impact social development, a finding not supported by the current results (Jones et al., 2013; Taylor et al., 2006). It is possible that young children with early risk factors such as low SES or less quality parenting environments are identified for intervention and thus do not present with problems at age 12 years; although this should be confirmed. Future research should also aim to identify a wider range of longitudinal predictors of persistent peer problems. It is likely there is a complex interplay of a number of child, family and environment factors across childhood that could influence their 12-year outcome (Raver & Zigler, 1997). Despite this, two important early risk factors have been identified in the current study which can aid assessment and intervention pursuits with EPT born children.

The results from the current study have a number of clinical implications. The most pertinent point is that early intervention is necessary and assessment of at-risk EPT/VPT born children should be tied into routine follow-up assessments in clinical practice. Potential risk factors for a poor trajectory of peer relationship difficulties over time include being born EPT; having poor cognitive ability at age 4 years, and having high scores of hyperactivity/inattention at age 4 years. Children born EPT with high peer problem scores at age 4 years should also be identified for intervention due to the worsening nature of the EPT groups peer problems over time. Further risk factors identified by pre-existing research include neonatal risk factors such as cerebral abnormalities, SES, maternal anxiety and negative parenting. These risk factors are easily identifiable therefore meaning that identification of these children can be relatively low-cost.

Due to the diversity in child and family factors associated with children who present with peer problems it is clear that a multi-modal and comprehensive intervention should be applied to these children. For example, interventions such as Incredible Years, Triple P, school wide interventions and peer mentoring (discussed in Chapter Six and Seven) would be appropriate options given their promising results with children with similar difficulties in the general population (Evans & Roberts, 1987; Hair et al., 2002; Mize, 2005; Sanders et al., 2014). The

widening gap between the EPT and VPT and FT born children across childhood also indicates that at–risk children should be monitored over time to examine intervention effectiveness.

This prospective longitudinal study has a number of strengths. First, to the best of the author's knowledge, no other study has examined the trajectory of peer problems across childhood for EPT, VPT and FT born children. Therefore, the current study provides unique information about the social outcomes of EPT and VPT birth in a contemporary cohort. The examination of peer relationship difficulties over four time points with parent and teacher report is also comprehensive. The high retention rate of participants in combination with these four time points of data collection meant that a large amount of data was collected with little missing data for the parents report.

Despite these strengths, there are some limitations to report. Most notably, the small sample size of EPT and VPT born participants meant that analyses for the current study lacked statistical power. Furthermore, it restricted the analysis of neonatal predictors on 12-year peer outcomes which otherwise may have provided important information. Secondly, there was some missing data within the teacher responses over time which particularly resulted in reduced statistical power for these analyses. Another limitation is that social competence was not comprehensively assessed at each follow-up age meaning the current study was limited to reliance on a broad behavioural screening measure. Finally, the associated risk factors at age 12 (identified in Chapter Six) were not all measured at age 4 years, so the current study could not examine whether they were also important risk factors at age 4 years. As a result of these limitations, it is important that these findings are considered as preliminary and require replication for confirmation.

In conclusion, the present study's findings, although preliminary, suggest that children born EPT are at an increased risk of persistent peer relationship difficulties, compared to their VPT and FT peers. Peer problems emerge early and are consistent throughout childhood and into pre-adolescence. Finally, low cognitive ability and increased hyperactivity/inattention difficulties at age 4 years may serve as risk factors for identifying those who may be at the highest risk of persistent peer problems.

"I feel really lonely and sad. I am very excited for High School so I can make new friends and start fresh."

– Female EPT participant (born at 26 weeks)

Chapter Nine

Summary and Conclusions

This thesis has presented findings from an ongoing longitudinal study which has prospectively followed the neuro-development of a regionally representative sample of children born EPT and VPT. This thesis specifically focused on the development of social competence of these at-risk children and was based on the tri-component model of social competence. The tri-component model delineates three separate yet important components of social competence: social adjustment; social performance; and social skills; these formed a framework for this thesis. In their 12th year and over a two-year period participants took part in a neurodevelopmental follow-up assessment at their 12th birthday which included multi-informant assessment of the children's social development. A systematic review and three studies were then undertaken as part of this thesis in order to a) provide a comprehensive descriptive profile of the social development of these children, b) highlight awareness of the social difficulties they encounter and c) highlight areas for intervention which, if targeted, may reduce these impactful experiences. Specific aims of this thesis were:

1) To describe the between-group differences in the social adjustment of preadolescent children born EPT (<28 weeks gestation) and VPT (<32 weeks gestation) relative to their FT peers at age 12 years and to identify family social background and concurrent child characteristics associated with poorer social adjustment at age 12 years.
2) To examine the between-group differences of the EPT, VPT and FT born children on the two lower components of the tri-component model, social skills and social performance at age 12 years, and to examine the role of these social skill and social performance components of the tri-component model in explaining the between-group differences seen for social adjustment outcomes at age 12 years.

3) To examine the role of the child and family variables identified in Aim Two in explaining the between-group differences in social adjustment outcomes, in combination with and in comparison to social skill and social performance factors.
4) To examine longitudinally the development of peer problems in children born EPT and VPT in comparison to children born FT at age 4, 6, 9 and 12 years and to longitudinally identify risk and resilience factors at age 4 years that may predict poor peer relationships at age 12 years.

The main findings of this thesis will be briefly outlined below. As each results section discussed strengths, limitations and implications pertinent to the results presented within each chapter, the strengths and limitations section in this chapter will provide a more general critique of the research in this thesis. Following this, implications of the findings and areas for future research will be discussed. This chapter will then conclude the thesis.

9.1 Main Findings

Although the majority of children born EPT will develop adequate social competence, they are at increased risk of experiencing more social difficulties in comparison to their VPT and FT counterparts. The main findings are summarised below (see Figure F.1 in Appendix F for a visual display of research results).

1) *Friendships:* Parents reported children born EPT to have fewer friends than VPT and FT born children. Specifically, 14% of EPT born children were reported by parents to have no friends, compared to 0-1% of VPT and FT born children. Child report showed a similar pattern but did not attain statistical significance. More EPT born children (16%), however, reported to be unsatisfied with the number of friends they had compared with the VPT and FT born children (1-2%). Positively, all groups of children reported similar mean age of best friend (12 years) and similar high quality and stable best friendships (3 years or more).
2) *Peer Problems:* Parents and teachers reported that EPT born children had higher levels of peer problems from age 4 years through to age 12 years compared with VPT and FT born children. At age 12 years, EPT born children were reported to have a 4-11 fold higher risk than VPT and FT born children, according to parent and teacher report. Associated risk factors of peer problems at age 12 years included lower math fluency scores, and higher levels of hyperactivity/inattention and emotional difficulties.
3) *Victimization*: More EPT and VPT born children (14% and 12%, respectively) reported frequent victimization compared to FT born children (4%). Physical characteristics at age 12 years which put the children at risk of frequent peer victimization were a higher BMI,

vision problems and less pubertal development. Increased hyperactivity/inattention also put children at increased risk of frequent victimization at age 12 years.

4) *Social Performance*: EPT born children had poorer prosocial behaviour compared to FT born children but this was only according to teacher report. There were no significant differences found for aggressive behaviour between the three groups. According to parent report, more EPT born children (25%) never spent time with friends than the VPT and FT born children (8% and 6%, respectively).
5) *Social Skills:* At age 12 years, EPT born children had higher levels of interpersonal skill difficulties than FT born children. Positively rejection sensitivity and attachment difficulties were not different between the three groups.
6) *Tri-component model*: All social skills and two social performance variables (bullying and social networking) were associated with the social adjustment outcome of having significant peer problems at age 12 years. With the inclusion of associated 12 year characteristics (math fluency, hyperactivity/inattention and emotional difficulties) this model explained over 50% of the variance in group outcome. Although interpersonal skills and rejection sensitivity were associated with victimization, they did not remain so after inclusion of 12-year hyperactivity/inattention and physical outcome variables in the regression analysis, suggesting that the victimization of these children is primarily a result of physical and behavioural characteristics. The final model for victimization which included only physical and behavioural characteristics explained only 22% of the variance suggesting further research needs to highlight additional risk factors.
7) *4 year predictors***:** Children with low cognitive ability, and higher levels of hyperactivity/inattentive behaviour at age 4 years were at increased risk of peer relationship problems at age 12 years than children with normal or high IQ or those with less hyperactivity/inattention difficulties.

9.2 Strengths and Limitations

There are a number of strengths of this thesis. The data was obtained from a study with a prospective, longitudinal design which had studied the EPT/VPT born children from birth. The sample of EPT and VPT born children was regionally representative and all premature babies that were born within the region were given the opportunity to participate. This increases the generalisability of the results to other EPT/VPT born children in New Zealand. It is further considered that these results are generalizable to other developed countries in the Western world. Additionally, this thesis also followed a healthy representative control group who were randomly selected and matched to the EPT and VPT born children for sex, and date of birth. Controlling for and discussing the impact of between-group differences (such as SES, maternal education,

cognitive ability and motor ability) which may influence the results also adds strength to the current thesis. Splitting the VPT group into those born EPT and those born VPT helped to identify and clarify the social profiles of these two heterogeneous groups.

Across the 12 years of follow-up studies, a high retention rate was maintained and comprehensive neuro-developmental assessments at each age meant there was a large longitudinal database of variables which could be accessed with little missing data. Furthermore, the thesis used multiple informants to gather data and the neuro-developmental assessments were conducted by expert and trained research assistants. There was strict adherence to guidelines for blinding of birth group status, and all assessment procedures in order to reduce the amount of error or bias that may result from inconsistency within and between assessments. The child questionnaire was completed on a computer, which reduced human error in transcribing the data. These aspects of the study increased the reliability of the data analysed.

Despite these strengths, there are also some limitations to report. The most salient limitation would be the lack of a comprehensive assessment of each domain of social competence in the tri-component model. For example, interpersonal skills were based on a three-item scale and the SDQ subscales are each based on five items, which reduces the reliability of the results from these measures. The SDQ is psychometrically sound, and both measures had adequate internal reliability, but it must be cautioned that this potential lack of reliability may have led to an over or under-estimation of socio-emotional difficulties. Although not feasible within the wider study due to the already large workload required from parents, teachers and children, more comprehensive measures, such as the Social Skills Improvement System Rating Scales for social skills (Gresham & Elliott, 2008; Gresham & Elliott, 1990) would have been more preferable, especially given the large influence these variables had in the results.

Another measurement issue was the ceiling effect which seems to have occurred with the Friendship Quality Questionnaire, attachment questionnaire (IPPA-R) and the rejection sensitivity questionnaire (CRSQ). Ceiling effects result in smaller between-group differences which are harder to detect statistically. This occurred despite the selection of this measure after a comprehensive search of the literature to obtain psychometrically sound and developmentally appropriate measures. Furthermore, some measures such as the angry rejection sensitivity subscale may have lacked the sensitivity to detect subtle between-group differences, as shown by non-statistically significant results that produced small effect sizes which may have been a result of ceiling effects and/or small sample sizes. Future research should therefore aim to be more qualitative when discussing friendships with the children in order to get an objective and comprehensive view of the quality of their friendships and socio-cognitive skills. Alternatively, it would be beneficial and more reliable to also get their reported best friend to complete a questionnaire, which was not done for the purposes of the current study.

Another limitation of the current study was that social competence was not measured comprehensively at any other neurodevelopmental follow-up assessment. This restricted longitudinal analyses of friendship and victimization data over time and limited this thesis in being able to tease out the direction of causal relationships.

There are some limitations with the data and statistical procedures to report. The EPT and VPT born children at times showed larger variation in their scores than the FT born children. Additionally, due to the use of clinical measures, some scales were not normally distributed, as few children scored highly on these measures. Although this is expected and commonly found in the preterm literature, this reduces the specificity of the results. However, all parametric tests were repeated using non-parametric alternatives with no significant changes occurring in the non-parametric analyses. Furthermore, influential outliers were identified and dealt with appropriately (for example, they were either removed or replaced with the next highest value and analyses were run with and without them to examine their influence on results). Although it was beneficial to split the VPT group into those born EPT and those born VPT, this resulted in sample size reduction for both groups. This subsequently restricted the statistical power available to perform some analyses, such as separate logistic regressions for EPT born children which could have identified unique predictors of peer relationship difficulties that were specifically relevant to EPT born children only.

One final limitation to consider is that, although out of our control due to the earthquake that occurred in Christchurch, not all of the assessments were completed within 2 weeks of the children's 12th birthday; however, it is thought that the influence of this would be minimal in the context of measuring social competence. Given that EPT born children are at risk of cognitive, motor and emotional difficulties, it is possible that the EPT born children were more disturbed by the earthquake than FT born children resulting in an increase in friend and peer relationship problems at this age and may further explain their increase in difficulties at age 12 years. In this thesis there is no way of disentangling the possible differential impact of the earthquake on the children from their birth status, but it does highlight the need for more research into the resilience of such children to a variety of adverse life circumstances.

9.3 Implications

Despite the limitations already discussed, this research considerably contributes to the understanding of the development of social competence in EPT and VPT born children. As the field of social competence research is rather disjointed and complex, this thesis also contributes to general developmental literature in quantitatively assessing the tri-component model of social competence for use as a framework in this area of research. Although each chapter has discussed major implications relevant to their respective results, there are some further implications to be discussed.

Firstly, this thesis demonstrated support for the hypothesis that EPT born children are at risk of a range of social competence difficulties such as having fewer/no friends, and more peer problems and victimization than FT born children. In contrast, VPT born children were not at increased risk of friendship or peer relationship problems, but were found to be at risk of peer victimization compared to their FT born peers. These results highlight that the neuro-developmental follow-up assessments of children born EPT/VPT should include the assessment of social competence difficulties. This thesis has identified that there is an increased risk of social problems if a 4 year old child has cognitive or hyperactivity/inattention difficulties or if a 12 year old child presents with hyperactivity/inattention problems or emotional problems, or spends no time with friends. This thesis demonstrated that if EPT born children are not identified at an early age then they are at risk of an increasingly poor trajectory of social skills through to age 12 years, a point in their life-course where they are preparing to enter adolescence and high-school. Beginning a new school with poor social skills may put them at risk of poorer school engagement. Furthermore, in adolescence, peer relationships become a critical part of developmental learning and thus it may be that EPT born children are at risk of a less than optimal experience of these crucial developmental transitions.

Given that not all EPT/VPT born children are at risk of social competence difficulties, parents of infants born EPT/VPT should be advised of the developmental risks their child has so that they can be prepared to provide an 'enriched environment' for their child from an early age. Furthermore, 'wrap-around' intervention services should be interweaved into the medical care and educational practices provided for these children. Not only should health and educational policies recommend targeted individual interventions but they should also recommend that interventions be parent, teacher and school-focused. A systemic approach to intervention increases communication between the people and environments the child engages with and is influenced by, which means that identification and intervention of at-risk children is more likely to occur. One such model which could be of practical use for this population is the use of a green, orange, and red-flag assessment summary which can be easily used by clinicians and teachers so that developmental anomalies are flagged at regular reviews, not overlooked, and the child can be referred for more comprehensive assessment or at least monitored more closely until the next formal assessment. Also of particular importance is that there must be an increase in communication and education for parents, teachers and children, about the peer victimization that is occurring in our schools, which has been shown to have significant adverse effects on long-term development (Lereya et al., 2015). As discussed in Chapter Eight, the risk factors highlighted in this thesis are easily identifiable in children and thus there is little reason these children should go undetected and subsequently experience social difficulties.

In terms of theoretical implications, the tri-component model was useful as a structure and framework to guide comprehensive assessment and understanding of the nature of the children's social difficulties. This research showed that it was beneficial to comprehensively examine all components of the model. Future research should use this model, and it is likely that such a framework will also be useful in guiding assessments and intervention strategies. This thesis also is important in showing that there are complex processes involved in the development of social competence and so the inclusion of a broad range of variables is important in capturing and predicting the trajectory of the development of social problems in children. Despite the usefulness of the tri-component model in understanding children with peer problems, a separate model may be needed to further understand and explain those who are victimized.

9.4 Future Research

The next step for research in this domain to take is for studies to replicate the findings of this thesis. Studies need to keep addressing and describing the social development of EPT and VPT born children in order to increase the breadth of knowledge in this area and to monitor the prognosis and trajectory of social difficulties into adolescence and adulthood. Any future research conducted in the area of social competence should base their method on a comprehensive model of social competence and aim to have a longitudinal focus. Results have also supported the separation of EPT and VPT born children as heterogeneous groups. Those born at the youngest ages are at increased risk of a range of social difficulties as opposed to VPT born children. Subsuming the two groups may mean that the effects of the EPT born group may also be attributed to VPT born children if they are treated as one homogenous group. Furthermore, given the larger numbers of VPT born participants in comparison to EPT born participants within this research, research may fail to find differences between them (due to a lack of statistical power), and thus fail to highlight the real needs of EPT. Additionally, even if EPT problems are recognised, failure to differentiate between the two gestational groups may lead to health and educational resources being spread over both groups, when concentration on EPT may yield more benefits.

Future research should also aim to establish the causal direction of the variables in the development of social competence. Longitudinal studies that include social competence measures from the beginning of their studies would aid the examination of this. Specific areas of focus should be to:

1) Examine the influence of neonatal characteristics such as IVH and PVL on social competence and to understand the complex interplay of the variables found to be important in the development of social competence, for example, motor, vision, hyperactivity, interpersonal skills, maths fluency, and emotional difficulties;

2) Examine a wider range of possible risk and resilience factors that may contribute to social outcomes in these children;
3) Examine the mediating or moderating roles of social and other neuro-developmental outcomes cross-sectionally and longitudinally and;
4) Examine the role of developmental cycles which may serve to amplify the effects of impaired social development over time.

This type of research could subsequently result in the development of a preterm-specific theory that can include neonatal, family, and child risk and resilience factors of social development. A model such as that would be important for consistent routine assessment and intervention in clinical practice. Additionally, it would also be of importance to measure the predictive validity of the SDQ peer problems subscale in screening adequately for those who have more substantial social competence problems.

In terms of victimization, studies should more qualitatively assess the children's experiences of being bullied and aim to identify additional variables which may explain more variance in social adjustment outcome. Finally, future research must begin to focus on interventions for EPT/VPT born children during early childhood that can reduce the risk of social competence problems occurring and exacerbating over time.

9.5 Conclusion

In conclusion, the current thesis has presented findings from a 12-year follow-up study which examined the social competence of EPT and VPT born children in comparison to FT born children. This is one of few studies worldwide that directly examines the social competence of children born EPT and VPT and it is one of two studies to do so comprehensively. Furthermore, it is the only one to do so with a longitudinal analysis across childhood and up to age 12 years. Results supported the hypothesis that children born at the lowest gestational ages would have social competence difficulties. While not all EPT/VPT born children experience difficulties with their social development, more EPT born children have difficulties compared to VPT or FT born children. VPT born children were only found to be at risk of victimization, against hypotheses that they would also be at risk of all social problems. It is important that research continues in this area in order to help alleviate the social difficulties that these children face. This in turn may provide renewed support to these children who are at increased risk of experiencing a range of neurodevelopmental difficulties which would ultimately serve to increase their overall enjoyment of life.

References

Aarnoudse-Moens, C., Smidts, D., Oosterlaan, J., Duivenvoorden, H., & Weisglas-Kuperus, N. (2009). Executive function in very preterm children at early school age. *Journal of abnormal child psychology, 37*(7), 981-993.

Aarnoudse-Moens, C., Weisglas-Kuperus, N., Duivenvoorden, H., van Goudoever, J., & Oosterlaan, J. (2013). Executive function and IQ predict mathematical and attention problems in very preterm children. *PloS one, 8*(2), e55994.

Aarnoudse-Moens, C., Weisglas-Kuperus, N., van Goudoever, J., & Oosterlaan, J. (2009). Meta-analysis of neurobehavioral outcomes in very preterm and/or very low birth weight children. *Pediatrics, 124*(2), 717-728.

Anderson, P., & Doyle, L. (2004). Executive functioning in school-aged children who were born very preterm or with extremely low birth weight in the 1990s. *Pediatrics, 114*(1), 50-57.

Anderson, P., Doyle, L., & Group, V. I. C. S. (2003). Neurobehavioral outcomes of school-age children born extremely low birth weight or very preterm in the 1990s. *JAMA, 289*(24), 3264-3272. doi: 10.1001/jama.289.24.3264

Appleyard, K., Egeland, B., Dulmen, M. H. M., & Alan Sroufe, L. (2005). When more is not better: The role of cumulative risk in child behavior outcomes. *Journal of child psychology and psychiatry, 46*(3), 235-245.

Armsden, G. C., & Greenberg, M. T. (1987). The Inventory of Parent and Peer Attachment - Individual-Differences and Their Relationship to Psychological Well-Being in Adolescence. *Journal of Youth and Adolescence, 16*(5), 427-454. doi: Doi 10.1007/Bf02202939

Arnold, K.-H., & Lindner-Müller, C. (2012). Assessment and development of social competence: introduction to the special issue. *Journal for Educational Research Online/Journal für Bildungsforschung Online, 4*(1), 7-19.

Arpi, E., & Ferrari, F. (2013). Preterm birth and behaviour problems in infants and preschool-age children: a review of the recent literature. *Developmental Medicine & Child Neurology, 55*(9), 788-796.

Asher, S. R., & Renshaw, P. D. (1981). 10 Children without friends: social knowledge and social-skill training. *The development of children's friendships, 2*, 273.

Australian and New Zealand Neonatal Network. (2009). *Report of the Australian and New Zealand Neonatal Network 2006*. Sydney, ANZNN.

Bagwell, C. L., Newcomb, A. F., & Bukowski, W. M. (1998). Preadolescent friendship and peer rejection as predictors of adult adjustment. *Child development, 69*(1), 140-153.

Baron, I. S., Erickson, K., Ahronovich, M. D., Baker, R., & Litman, F. R. (2011). Neuropsychological and behavioral outcomes of extremely low birth weight at age three. *Dev Neuropsychol, 36*(1), 5-21. doi: 10.1080/87565641.2011.540526

Baron, I. S., & Rey-Casserly, C. (2010). Extremely preterm birth outcome: A review of four decades of cognitive research. [Peer Reviewed]. *Neuropsychology Review, .20*(4), pp. doi: 10.1007/s11065-010-9132-z 20512418

Barre, N., Morgan, A., Doyle, L. W., & Anderson, P. J. (2011). Language abilities in children who were very preterm and/or very low birth weight: a meta-analysis. *J Pediatr, 158*(5), 766-774.e761. doi: 10.1016/j.jpeds.2010.10.032

Bayless, S., Pit-ten Cate, I. M., & Stevenson, J. (2008). Behaviour difficulties and cognitive function in children born very prematurely. *International Journal of Behavioral Development, 32*(3), 199-206.

Beck, J. S. (2011). *Cognitive behavior therapy: Basics and beyond*: Guilford Press.

Beck, S., Wojdyla, D., Say, L., Betran, A. P., Merialdi, M., Requejo, J. H., . . . Van Look, P. F. A. (2010). The worldwide incidence of preterm birth: a systematic review of maternal

mortality and morbidity. *Bulletin of the World Health Organization, 88*(1), 31-38. doi: Doi 10.2471/Blt.08.062554

Beelman, A., Pfingsten, U., & Losel, F. (1994). Effects of training social competence in children: A meta-analysis of recent evaluation studies. *Journal of Clinical Child Psychology, 23*(3), 260-271.

Bejerot, S., & Humble, M. B. (2013). Childhood clumsiness and peer victimization: a case-control study of psychiatric patients. *Bmc Psychiatry, 13*.

Bejerot, S., Plenty, S., Humble, A., & Humble, M. B. (2013). Poor Motor Skills: A Risk Marker for Bully Victimization. *Aggressive Behavior, 39*(6), 453-461. doi: Doi 10.1002/Ab.21489

Bellanti, C. J., & Bierman, K. L. (2000). Disentangling the impact of low cognitive ability and inattention on social behavior and peer relationships. *Journal of clinical child psychology, 29*(1), 66-75.

Berndt, T. J. (1982). The Features and Effects of Friendship in Early Adolescence. *Child Development, 53*(6), 1447-1460. doi: DOI 10.1111/j.1467-8624.1982.tb03466.x

Berndt, T. J. (2002). Friendship quality and social development. *Current directions in psychological science, 11*(1), 7-10.

Bhutta, A. T., Cleves, M. A., Casey, P. H., Cradock, M. M., & Anand, K. J. (2002). Cognitive and behavioral outcomes of school-aged children who were born preterm: a meta-analysis. *JAMA, 288*(6), 728-737.

Bierman, K. L., & Furman, W. (1984). The effects of social skills training and peer involvement on the social adjustment of preadolescents. *Child development*, 151-162.

Blencowe, H., Cousens, S., Oestergaard, M. Z., Chou, D., Moller, A. B., Narwal, R., . . . Lawn, J. E. (2012). National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. *Lancet, 379*(9832), 2162-2172. doi: 10.1016/S0140-6736(12)60820-4

Bora, S., Pritchard, V., Chen, Z., Inder, T., & Woodward, L. (2014). Neonatal cerebral morphometry and later risk of persistent inattention/hyperactivity in children born very preterm. *Journal of child psychology and psychiatry, 55*(7), 828-838.

Bora, S., Pritchard, V., Moor, S., Austin, N., & Woodward, L. (2011). Emotional and behavioural adjustment of children born very preterm at early school age. *Journal of Paediatrics and Child Health, 47*(12), 863-869. doi: DOI 10.1111/j.1440-1754.2011.02105.x

Boulton, M. J. (1999). Concurrent and longitudinal relations between children's playground behavior and social preference, victimization, and bullying. *Child development*, 944-954.

Boulton, M. J., & Smith, P. K. (1994). Bully Victim Problems in Middle-School Children - Stability, Self-Perceived Competence, Peer Perceptions and Peer Acceptance. *British Journal of Developmental Psychology, 12*, 315-329.

Bowlby, J. (1973). *Attachment and loss: Vol. 2: Separation*: Hogarth Press and the Institute of Psycho-Analysis.

Brisch, K. H., Bechinger, D., Betzler, S., Heinemann, H., Kachele, H., Pohlandt, F., . . . Buchheim, A. (2005). Attachment quality in very low-birthweight premature infants in relation to maternal attachment representations and neurological development. *Parenting: Science and Practice, 5*(4), 311-331.

Bronfenbrenner, U., & Morris, P. A. (1998). The ecology of developmental processes.

Buhs, E. S., Ladd, G. W., & Herald, S. L. (2006). Peer exclusion and victimization: Processes that mediate the relation between peer group rejection and children's classroom engagement and achievement? *Journal of Educational Psychology, 98*(1), 1-13. doi: Doi 10.1037/0022-0663.98.1.1

Burnett, A. C., Anderson, P. J., Cheong, J., Doyle, L. W., Davey, C. G., & Wood, S. J. (2011). Prevalence of psychiatric diagnoses in preterm and full-term children, adolescents and young adults: a meta-analysis. *Psychological medicine, 41*(12), 2463-2474.

Calkins, S. D., Gill, K., & Williford, A. (1999). Externalizing problems in two-year-olds: Implications for patterns of social behavior and peers' responses to aggression. *Early Education and Development, 10*(3), 267-288.

Campbell, J. J., Lamb, M. E., & Hwang, C. P. (2000). Early child-care experiences and children's social competence between 11/2 and 15 years of age. *Applied Developmental Science, 4*(3), 166-176.

Carr, A. (2006). *The handbook of child and adolescent clinical psychology : a contextual approach* (2nd ed.). New York: Routledge.

Cavazos-Rehg, P. A., Krauss, M. J., Spitznagel, E. L., Bommarito, K., Madden, T., Olsen, M. A., . . . Bierut, L. J. (2014). Maternal Age and Risk of Labor and Delivery Complications. *Maternal and child health journal, 19*(6), 1202-1211.

Cavell, T. (1990). Social Adjustment, Social Performance, and Social Skills: A Tri-Component Model of Social Competence. *Journal of Clinical Child Psychology, 19*(2), 111-122. doi: 10.1207/s15374424jccp1902_2

Chang, H. H., Larson, J., Blencowe, H., Spong, C. Y., Howson, C. P., Cairns-Smith, S., . . . A, B. T. S. P. P. (2013). Preventing Preterm Births: Analysis of Trends and Potential Reductions With Interventions in 39 Countries With Very High Human Development Index EDITORIAL COMMENT. *Obstetrical & Gynecological Survey, 68*(5), 339-341. doi: DOI 10.1097/01.ogx.0000430376.22369.5c

Charkaluk, M. L., Truffert, P., Fily, A., Ancel, P. Y., Pierrat, V., & group, E. s. (2010). Neurodevelopment of children born very preterm and free of severe disabilities: the Nord-Pas de Calais Epipage cohort study. *Acta Paediatr, 99*(5), 684-689. doi: 10.1111/j.1651-2227.2010.01695.x

Clark, C., Woodward, L., Horwood, J., & Moor, S. (2008a). Development of emotional and behavioral regulation in children born extremely preterm and very preterm: biological and social influences. *Child Dev, 79*(5), 1444-1462. doi: 10.1111/j.1467-8624.2008.01198.x

Clark, C., Woodward, L., Horwood, J., & Moor, S. (2008b). Development of emotional and behavioral regulation in children born extremely preterm and very preterm: Biological and social influences. [Peer Reviewed]. *Child Development, .79*(5), pp. doi: 10.1111/j.1467-8624.2008.01198.x 18826535

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*: L. Erlbaum Associates.

Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin, 115*(1), 74-101. doi: 10.1037/0033-2909.115.1.74

Cumming, G. (2013). *Understanding the new statistics: Effect sizes, confidence intervals, and meta-analysis*: Routledge.

D'Zurilla, T. J., & Goldfried, M. R. (1971). Problem solving and behavior modification. *Journal of abnormal psychology, 78*(1), 107.

Davis, N. M., Ford, G. W., Anderson, P. J., & Doyle, L. W. (2007). Developmental coordination disorder at 8 years of age in a regional cohort of extremely-low-birthweight or very preterm infants. *Developmental Medicine and Child Neurology, 49*(5), 325-330.

de Graaf, I., Speetjens, P., Smit, F., de Wolff, M., & Tavecchio, L. (2008). Effectiveness of the Triple P Positive Parenting Program on behavioral problems in children: a meta-analysis. *Behav Modif, 32*(5), 714-735. doi: 10.1177/0145445508317134

De Schuymer, L., De Groote, I., Striano, T., Stahl, D., & Roeyers, H. (2011). Dyadic and triadic skills in preterm and full term infants: a longitudinal study in the first year. *Infant Behav Dev, 34*(1), 179-188. doi: 10.1016/j.infbeh.2010.12.007

DeGangi, G. A. (1995). *Infant/Toddler Symptom Checklist: A screening tool for parents*: Psychological Corp.

DeGangi, G. A., Breinbauer, C., Roosevelt, J. D., Porges, S., & Greenspan, S. (2000). Prediction of childhood problems at three years in children experiencing disorders of regulation during infancy. *Infant Mental Health Journal, 21*(3), 156-175.

Delobel-Ayoub, M., Arnaud, C., White-Koning, M., Casper, C., Pierrat, V., Garel, M., . . . Larroque, B. (2009). Behavioral problems and cognitive performance at 5 years of age after very preterm birth: The EPIPAGE Study. [Peer Reviewed]. *Pediatrics, .123*(6), pp. doi: 10.1542/peds.2008-1216 19482758

Delobel-Ayoub, M., Arnaud, C., White-Koning, M., Casper, C., Pierrat, V., Garel, M., . . . Group, E. S. (2009). Behavioral problems and cognitive performance at 5 years of age after very preterm birth: the EPIPAGE Study. *Pediatrics, 123*(6), 1485-1492. doi: 10.1542/peds.2008-1216

Delobel-Ayoub, M., Kaminski, M., Marret, S., Burguet, A., Marchand, L., N'Guyen, S., . . . Group, E. S. (2006). Behavioral outcome at 3 years of age in very preterm infants: the EPIPAGE study. *Pediatrics, 117*(6), 1996-2005. doi: 10.1542/peds.2005-2310

Delobel-Ayoub, M., Kaminski, M., Marret, S., Burguet, A., Marchand, L., N'Guyen, S., . . . Grp, E. S. (2006). Behavioral outcome at 3 years of age in very preterm infants: The EPIPAGE study. *Pediatrics, 117*(6), 1996-2005. doi: DOI 10.1542/peds.2005-2310

Denham, S. A., Blair, K. A., DeMulder, E., Levitas, J., Sawyer, K., Auerbach–Major, S., & Queenan, P. (2003). Preschool emotional competence: Pathway to social competence? *Child development, 74*(1), 238-256.

Devine, K. A., Holmbeck, G. N., Gayes, L., & Purnell, J. Q. (2012). Friendships of children and adolescents with spina bifida: Social adjustment, social performance, and social skills. [Peer Reviewed]. *Journal of Pediatric Psychology, .37*(2), pp. doi: 10.1093/jpepsy/jsr075 21930663

Dodge, K. A., & Coie, J. D. (1987). Social-information-processing factors in reactive and proactive aggression in children's peer groups. *Journal of personality and social psychology, 53*(6), 1146.

Dodge, K. A., McClaskey, C. L., & Feldman, E. (1985). Situational approach to the assessment of social competence in children. *Journal of consulting and clinical psychology, 53*(3), 344.

Donat, J. F., Okazaki, H., Kleinberg, F., & Reagan, T. J. (1979). Intraventricular Hemorrhages in Full Term and Premature Infants. *Obstetrical & Gynecological Survey, 34*(3), 217-219.

Downey, G., Lebolt, A., Rincon, C., & Freitas, A. L. (1998). Rejection sensitivity and children's interpersonal difficulties. *Child Dev, 69*(4), 1074-1091.

Downey, G., Lebolt, A., Rincón, C., & Freitas, A. L. (1998). Rejection sensitivity and children's interpersonal difficulties. *Child development*, 1074-1091.

Edgin, J., Inder, T., Anderson, P., Hood, K., Clark, C., & Woodward, L. (2008). Executive functioning in preschool children born very preterm: relationship with early white matter pathology. *Journal of the International Neuropsychological Society, 14*(01), 90-101.

Elgen, S. K., Leversen, K. T., Grundt, J. H., Hurum, J., Sundby, A. B., Elgen, I. B., & Markestad, T. (2012). Mental health at 5 years among children born extremely preterm: a national population-based study. *Eur Child Adolesc Psychiatry, 21*(10), 583-589. doi: 10.1007/s00787-012-0298-1

Elley, W. B., & Irving, J. C. (2003). The Elley-Irving Socio-Economic Index: 2001 Census Revision. *New Zealand Journal of Educational Studies, 38*(1), 3-17.

Engels, R. C. M. E., Finkenauer, C., Meeus, W., & Deković, M. (2001). Parental attachment and adolescents' emotional adjustment: The associations with social skills and relational competence. *Journal of Counseling Psychology, 48*(4), 428.

Englund, N. M., Levy, A. K., Hyson, D. M., & Sroufe, L. A. (2000). Adolescent social competence: Effectiveness in a group setting. *Child Development, 71*(4), 1049-1060.

Evans, G. W., Li, D., & Whipple, S. S. (2013). Cumulative risk and child development. *Psychological Bulletin, 139*(6), 1342.

Evans, J., & Roberts, G. C. (1987). Physical competence and the development of children's peer relations. *Quest, 39*(1), 23-35.

Fanaroff, A. A. (2014). Quality improvement initiatives in neonatal intensive care. *Early Hum Dev, 90 Suppl 2*, S5-9. doi: 10.1016/S0378-3782(14)50003-5

Fanaroff, A. A., Stoll, B. J., Wright, L. L., Carlo, W. A., Ehrenkranz, R. A., Stark, A. R., . . . Network, N. N. R. (2007). Trends in neonatal morbidity and mortality for very low birthweight infants. *Am J Obstet Gynecol, 196*(2), 147 e141-148. doi: 10.1016/j.ajog.2006.09.014

Farooqi, A., Hagglof, B., Sedin, G., Gothefors, L., & Serenius, F. (2007). Mental health and social competencies of 10- to 12-year-old children born at 23 to 25 weeks of gestation in the 1990s: a Swedish national prospective follow-up study. *Pediatrics, 120*(1), 118-133. doi: 10.1542/peds.2006-2988

Fergusson, D., Stanley, L., & Horwood, L. J. (2009). Preliminary data on the efficacy of the Incredible Years basic parent programme in New Zealand. *Australian and New Zealand Journal of Psychiatry, 43*(1), 76-79.

Fergusson, D. M., & Horwood, L. J. (1979). MEASUREMENT OF SOCIOECONOMIC-STATUS FOR 1109 NEW-ZEALAND FAMILIES. *New Zealand Journal of Educational Studies, 14*(1), 58-66.

Fergusson, D. M., & Horwood, L. J. (1998). Early conduct problems and later life opportunities. *J Child Psychol Psychiatry, 39*(8), 1097-1108.

Fergusson, D. M., Horwood, L. J., & Ridder, E. M. (2005). Show me the child at seven: the consequences of conduct problems in childhood for psychosocial functioning in adulthood. *J Child Psychol Psychiatry, 46*(8), 837-849. doi: 10.1111/j.1469-7610.2004.00387.x

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*: Sage.

Foster-Cohen, S., Edgin, J., Champion, P., & Woodward, L. (2007). Early delayed language development in very preterm infants: Evidence from the MacArthur-Bates CDI. *Journal of child language, 34*(03), 655-675.

Foster-Cohen, S. H., Friesen, M. D., Champion, P. R., & Woodward, L. J. (2010). High prevalence/low severity language delay in preschool children born very preterm. *Journal of Developmental & Behavioral Pediatrics, 31*(8), 658-667.

Foulder-Hughes, L. A., & Cooke, R. W. I. (2003). Motor, cognitive, and behavioural disorders in children born very preterm. *Developmental Medicine & Child Neurology, 45*(02), 97-103.

Fox, C. L., & Boulton, M. J. (2006). Friendship as a moderator of the relationship between social skills problems and peer victimisation. *Aggressive Behavior, 32*(2), 110-121. doi: Doi 10.1002/Ab.20114

Frederick, B. P., & Olmi, D. J. (1994). Children with attention-deficit/hyperactivity disorder: A review of the literature on social skills deficits. *Psychology in the Schools*.

Geldard, K., & Geldard, D. (2008). *Personal counseling skills: An integrative approach. 2008*. Springfield, IL: Charles C Thomas Publisher; US.

Gentschel, D. A., & McLaughlin, T. F. (2000). Attention deficit hyperactivity disorder as a social disability: Characteristics and suggested methods of treatment. *Journal of Developmental and Physical Disabilities, 12*(4), 333-347.

Gioia, G., Espy, K. A., & Isquith, P. K. (2005). Behavior Rating Inventory of Executive Function–Preschool Version (BRIEF-P). *Odessa, FL: Psychological Assessment Resources*.

Goodman, R. (1997). The strengths and difficulties questionnaire: A research note. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 38*(5), 581-586. doi: DOI 10.1111/j.1469-7610.1997.tb01545.x

Goodman, R. (2001). Psychometric properties of the strengths and difficulties questionnaire. *Journal of the American Academy of Child and Adolescent Psychiatry, 40*(11), 1337-1345. doi: Doi 10.1097/00004583-200111000-00015

Goodwin, R. D., Fergusson, D. M., & Horwood, L. J. (2004). Early anxious/withdrawn behaviours predict later internalising disorders. *Journal of Child Psychology and Psychiatry, 45*(4), 874-883.

Green, K. D., Forehand, R., Beck, S. J., & Vosk, B. (1980). An assessment of the relationship among measures of children's social competence and children's academic achievement. *Child Development*, 1149-1156.

Gresham, F., & Elliott, S. N. (2008). Social skills improvement system (SSIS) rating scales. *Bloomington, MN: Pearson Assessments*.

Gresham, F. M., & Elliott, S. N. (1990). *Social skills rating system: Manual*: American Guidance Service.

Grindvik, A., Hodol, J., Vik, T., Evensen, K., Skranes, J., Brubakk, A.-M., & Indredavik, M. (2009). Bullying among adolescents with very low birth weight. *Acta paediatrica, 98*(6), 1049.

Gross, S. J., Mettelman, B. B., Dye, T. D., & Slagle, T. A. (2001). Impact of family structure and stability on academic outcome in preterm children at 10 years of age. *J Pediatr, 138*(2), 169-175. doi: 10.1067/mpd.2001.111945

Gullone, E., & Robinson, K. (2005). The inventory of parent and peer attachment - Revised (IPPA-R) for children: A psychometric investigation. *Clinical Psychology & Psychotherapy, 12*(1), 67-79. doi: Doi 10.1002/Cpp.433

Hack, M., Klein, N. K., & Taylor, H. G. (1995). Long-term developmental outcomes of low birth weight infants. *The future of children*, 176-196.

Hack, M., Schluchter, M., Cartar, L., Rahman, M., Cuttler, L., & Borawski, E. (2003). Growth of very low birth weight infants to age 20 years. *Pediatrics, 112*(1 Pt 1), e30-38.

Hack, M., Taylor, H. G., Drotar, D., Schluchter, M., Cartar, L., Andreias, L., . . . Klein, N. (2005). Chronic conditions, functional limitations, and special health care needs of school-aged children born with extremely low-birth-weight in the 1990s. *JAMA, 294*(3), 318-325. doi: 10.1001/jama.294.3.318

Hack, M., Taylor, H. G., Klein, N., Eiben, R., Schatschneider, C., & Mercuri-Minich, N. (1994). School-age outcomes in children with birth weights under 750 g. *N Engl J Med, 331*(12), 753-759. doi: 10.1056/NEJM199409223311201

Hair, E. C., Jager, J., & Garrett, S. B. (2002). *Helping teens develop healthy social skills and relationships: What the research shows about navigating adolescence*: Child Trends Washington.

Hallin, A. L., & Stjernqvist, K. (2011). Adolescents born extremely preterm: behavioral outcomes and quality of life. *Scand J Psychol, 52*(3), 251-256. doi: 10.1111/j.1467-9450.2010.00850.x

Hamilton, J. L., Kleiman, E. M., Rubenstein, L. M., Stange, J. P., Flynn, M., Abramson, L. Y., & Alloy, L. B. (2015). Deficits in emotional clarity and vulnerability to peer victimization and internalizing symptoms among early adolescents. *Journal of youth and adolescence*, 1-12.

Hanish, L. D., & Guerra, N. (2004). Aggressive victims, passive victims, and bullies: Developmental continuity or developmental change? *Merrill-Palmer Quarterly, 50*(1), 17-38.

Hartup, W. W., & Stevens, N. (1999). Friendships and adaptation across the life span. *Current Directions in Psychological Science, 8*(3), 76-79. doi: Doi 10.1111/1467-8721.00018

Harvey, S., Barry, A., Fitzgerald, J., Evans, I., & Bennett, S. Best Practice Outcome Measurement for Children and Young People with High and Complex Needs. *Focus, 4*, 1.

Hatzichristou, C., & Hopf, D. (1996). A multiperspective comparison of peer sociometric status groups in childhood and adolescence. *Child Development, 67*(3), 1085-1102.

Hayes, B., & Sharif, F. (2009). Behavioural and emotional outcome of very low birth weight infants–literature review. *The journal of maternal-fetal & neonatal medicine, 22*(10), 849-856.

Healy, E., Reichenberg, A., Nam, K. W., Allin, M. P. G., Walshe, M., Rifkin, L., . . . Nosarti, C. (2013). Preterm Birth and Adolescent Social Functioning–Alterations in Emotion-Processing Brain Areas. *The Journal of pediatrics, 163*(6), 1596-1604.

Henderson, S. E., Sudgen, D. A., Barnett, A. L., & Petermann, F. (1997). movement abc-2.

Henderson, S. E., Sugden, D. A., & Barnett, A. L. (2007). *Movement assessment battery for children-2: Movement ABC-2: Examiner's manual*: Pearson.

Heron, M., Sutton, P. D., Xu, J. Q., Ventura, S. J., Strobino, D. M., & Guyer, B. (2010). Annual Summary of Vital Statistics: 2007. *Pediatrics, 125*(1), 4-15. doi: DOI 10.1542/peds.2009-2416

Herrmann, C. (1997). International experiences with the Hospital Anxiety and Depression Scale-a review of validation data and clinical results. *Journal of psychosomatic research, 42*(1), 17-41.

Hille, E. T., den Ouden, A. L., Saigal, S., Wolke, D., Lambert, M., Whitaker, A., . . . Paneth, N. (2001). Behavioural problems in children who weigh 1000 g or less at birth in four countries. *Lancet, 357*(9269), 1641-1643. doi: 10.1016/S0140-6736(00)04818-2

Hoff, B., Hansen, B. M., Munck, H., & Mortensen, E. L. (2004). Behavioral and social development of children born extremely premature: 5-year follow-up. *Scand J Psychol, 45*(4), 285-292. doi: 10.1111/j.1467-9450.2004.00407.x

Hops, H., & Finch, M. (1985). Social competence and skill: A reassessment *Children's peer relations: Issues in assessment and intervention* (pp. 23-39): Springer.

Howson, C. P., Kinney, M. V., & Lawn, J. E. (2012). Born too soon: the global action report on preterm birth. *Geneva: World Health Organization*.

Hoza, B. (2007). Peer functioning in children with ADHD. *Journal of Pediatric Psychology, 32*(6), 655-663.

Hoza, B., Mrug, S., Gerdes, A. C., Hinshaw, S. P., Bukowski, W. M., Gold, J. A., . . . Arnold, L. E. (2005). What aspects of peer relationships are impaired in children with attention-deficit/hyperactivity disorder? *Journal of Consulting and Clinical Psychology, 73*(3), 411.

Hutchinson, E. A., De Luca, C. R., Doyle, L. W., Roberts, G., Anderson, P. J., & Group, V. I. C. S. (2013). School-age outcomes of extremely preterm or extremely low birth weight children. *Pediatrics, 131*(4), e1053-1061. doi: 10.1542/peds.2012-2311

Isquith, P. K., Crawford, J. S., Espy, K. A., & Gioia, G. A. (2005). Assessment of executive function in preschool-aged children. *Mental retardation and developmental disabilities research reviews, 11*(3), 209-215.

Iwata, S., Nakamura, T., Hizume, E., Kihara, H., Takashima, S., Matsuishi, T., & Iwata, O. (2012). Qualitative brain MRI at term and cognitive outcomes at 9 years after very preterm birth. *Pediatrics, 129*(5), e1138-e1147.

Johnson, S., Hennessy, E., Smith, R., Trikic, R., Wolke, D., & Marlow, N. (2009). Academic attainment and special educational needs in extremely preterm children at 11 years of age: the EPICure study. *Archives of Disease in Childhood-Fetal and Neonatal Edition, 94*(4), F283-F289.

Johnson, S., Hollis, C., Kochhar, P., Hennessy, E., Wolke, D., & Marlow, N. (2010a). Autism spectrum disorders in extremely preterm children. *J Pediatr, 156*(4), 525-531.e522. doi: 10.1016/j.jpeds.2009.10.041

Johnson, S., Hollis, C., Kochhar, P., Hennessy, E., Wolke, D., & Marlow, N. (2010b). Psychiatric disorders in extremely preterm children: longitudinal finding at age 11 years in the EPICure study. *Journal of the American Academy of Child & Adolescent Psychiatry, 49*(5), 453-463. e451.

Johnson, S., Hollis, C., Marlow, N., Simms, V., & Wolke, D. (2014). Screening for childhood mental health disorders using the Strengths and Difficulties Questionnaire: the validity of multi-informant reports. *Developmental Medicine & Child Neurology, 56*(5), 453-459.

Johnson, S., & Marlow, N. (2011). Preterm Birth and Childhood Psychiatric Disorders. *Pediatric Research, 69*(5), 11r-18r. doi: Doi 10.1203/Pdr.0b013e318212faa0

Jones, C. M., Welsh, A., Throback, I. N., Dorsch, P., Bakken, L. R., & Hallin, S. (2011). Phenotypic and genotypic heterogeneity among closely related soil-borne N2 - and N2 O-producing Bacillus isolates harboring the nosZ gene. *FEMS Microbiol Ecol, 76*(3), 541-552. doi: 10.1111/j.1574-6941.2011.01071.x

Jones, K., Champion, P., & Woodward, L. (2013). Social competence of preschool children born very preterm. [Peer Reviewed]. *Early Human Development, .89*(10), pp. doi: 10.1016/j.earlhumdev.2013.06.008 23870752

Jose, P. E., Ryan, N., & Pryor, J. (2012). Does Social Connectedness Promote a Greater Sense of Well-Being in Adolescence Over Time? *Journal of Research on Adolescence, 22*(2), 235-251.

Kajantie, E., Hovi, P., Raikkonen, K., Pesonen, A. K., Heinonen, K., Jarvenpaa, A. L., . . . Andersson, S. (2008). Young adults with very low birth weight: leaving the parental home and sexual relationships--Helsinki Study of Very Low Birth Weight Adults. *Pediatrics, 122*(1), e62-72. doi: 10.1542/peds.2007-3858

Kaufman, A. S. (1972). A short form of the Wechsler Preschool and Primary Scale of Intelligence. *Journal of Consulting and Clinical Psychology, 39*(3), 361.

Keltner, B. (1990). Family characteristics of preschool social competence among Black children in a Head Start program. *Child Psychiatry and Human Development, 21*(2), 95-108.

Kerr-Wilson, C. O., Mackay, D. F., Smith, G. C. S., & Pell, J. P. (2012). Meta-analysis of the association between preterm delivery and intelligence. *Journal of Public Health, 34*(2), 209-216.

Kinney, H. C. (2006). The near-term (late preterm) human brain and risk for periventricular leukomalacia: A review. *Seminars in Perinatology, 30*(2), 81-88. doi: DOI 10.1053/j.semperi.2006.02.006

Knops, N. B. B., Sneeuw, K. C. A., Brand, R., Hille, E. T. M., den Ouden, A. L., Wit, J.-M., & Verloove-Vanhorick, S. P. (2005). Catch-up growth up to ten years of age in children born very preterm or with very low birth weight. *BMC pediatrics, 5*(1), 26.

Kopp, C. B., Baker, B. L., & Brown, K. W. (1992). Social skills and their correlates: Preschoolers with developmental delays. *American Journal on Mental Retardation*.

Kouros, C. D., Cummings, E. M., & Davies, P. T. (2010). Early trajectories of interparental conflict and externalizing problems as predictors of social competence in preadolescence. [Peer Reviewed]. *Development and Psychopathology, .22*(3), pp. doi: 10.1017/S0954579410000258 20576176

Kraemer, H. C., Lowe, K. K., & Kupfer, D. J. (2005). *To your health: How to understand what research tells us about risk*: Oxford University Press.

La Greca, A. M., & Harrison, H. M. (2005). Adolescent peer relations, friendships, and romantic relationships: Do they predict social anxiety and depression? *Journal of Clinical Child and Adolescent Psychology, 34*(1), 49-61.

Ladd, G. W. (1990). Having friends, keeping friends, making friends, and being liked by peers in the classroom: Predictors of children's early school adjustment? *Child development*, 1081-1100.

Ladd, G. W. (2005). *Children's peer relations and social competence : a century of progress*. New Haven: Yale University Press.

Ladd, G. W., Price, J. M., & Hart, C. H. (1988). Predicting preschoolers' peer status from their playground behaviors. *Child development*, 986-992.

Laible, D. (2007). Attachment with parents and peers in late adolescence: Links with emotional competence and social behavior. *Personality and Individual Differences, 43*(5), 1185-1197.

Lansford, J. E., Malone, P. S., Dodge, K. A., Pettit, G. S., & Bates, J. E. (2010). Developmental cascades of peer rejection, social information processing biases, and aggression during middle childhood. *Development and psychopathology, 22*(03), 593-602.

Larroque, B., Ancel, P. Y., Marchand-Martin, L., Cambonie, G., Fresson, J., Pierrat, V., . . . group, E. S. (2011). Special care and school difficulties in 8-year-old very preterm children: the Epipage cohort study. *PLoS One, 6*(7), e21361. doi: 10.1371/journal.pone.0021361

Lemerise, E. A., & Arsenio, W. F. (2000). An integrated model of emotion processes and cognition in social information processing. *Child development, 71*(1), 107-118.

Lereya, S. T., Copeland, W. E., Costello, E. J., & Wolke, D. (2015). Adult mental health consequences of peer bullying and maltreatment in childhood: two cohorts in two countries. *Lancet Psychiatry, 2*(6), 524-531. doi: Doi 10.1016/S2215-0366(15)00165-0

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., . . . Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS Med, 6*(7), e1000100. doi: 10.1371/journal.pmed.1000100

Limperopoulos, C. (2009). Autism spectrum disorders in survivors of extreme prematurity. *Clin Perinatol, 36*(4), 791-805, vi. doi: 10.1016/j.clp.2009.07.010

LoBello, S. G. (1991). A short form of the Wechsler Preschool and Primary Scale of Intelligence-Revised. *Journal of School Psychology, 29*(3), 229-236.

Mangelsdorf, S. C., Plunkett, J. W., Dedrick, C. F., Berlin, M., Meisels, S. J., McHale, J. L., & Dichtellmiller, M. (1996). Attachment security in very low birth weight infants. *Developmental Psychology, 32*(5), 914.

Mansson, J., Stjernqvist, K., & Backstrom, M. (2014). *Behavioral outcomes at corrected age 2.5 years in children born extremely preterm. Journal of Developmental and Behavioral Pediatrics*

Markiewicz, D., Doyle, A. B., & Brendgen, M. (2001). The quality of adolescents' friendships: Associations with mothers' interpersonal relationships, attachments to parents and friends, and prosocial behaviors. *Journal of Adolescence, 24*(4), 429-445.

Marlow, N., Wolke, D., Bracewell, M. A., Samara, M., & Group, E. S. (2005). Neurologic and developmental disability at six years of age after extremely preterm birth. *New England Journal of Medicine, 352*(1), 9-19. doi: Doi 10.1056/Nejmoa041367

Marshall, W. A., & Tanner, J. M. (1969). Variations in pattern of pubertal changes in girls. *Archives of disease in childhood, 44*(235), 291.

Marshall, W. A., & Tanner, J. M. (1970). Variations in the pattern of pubertal changes in boys. *Archives of disease in childhood, 45*(239), 13-23.

Mash, E. J., & Barkley, R. A. (2014). *Child psychopathology*: Guilford Publications.
McCormick, M. C., Workman-Daniels, K., & Brooks-Gunn, J. (1996). The behavioral and emotional well-being of school-age children with different birth weights. *Pediatrics, 97*(1), 18-25.
McGrew, K. S., & Woodcock, R. W. (2001). *Woodcock-Johnson III technical manual*: Riverside Pub.
McLachlan, J., Zimmer-Gembeck, M. J., & McGregor, L. (2010). Rejection sensitivity in childhood and early adolescence: Peer rejection and protective effects of parents and friends. [Peer Reviewed]. *Journal of Relationships Research, .1*(1), pp. doi: 10.1375/jrr.1.1.31
Meijssen, D., Wolf, M.-J., van Bakel, H., Koldewijn, K., Kok, J., & van Baar, A. (2011). Maternal attachment representations after very preterm birth and the effect of early intervention. *Infant Behavior and Development, 34*(1), 72-80.
Meldrum, S. J., Strunk, T., Currie, A., Prescott, S. L., Simmer, K., & Whitehouse, A. J. (2013). Autism spectrum disorder in children born preterm-role of exposure to perinatal inflammation. *Front Neurosci, 7*, 123. doi: 10.3389/fnins.2013.00123
Menting, A. T., Orobio de Castro, B., & Matthys, W. (2013). Effectiveness of the Incredible Years parent training to modify disruptive and prosocial child behavior: a meta-analytic review. *Clin Psychol Rev, 33*(8), 901-913. doi: 10.1016/j.cpr.2013.07.006
Merrell, K. W., & Gimpel, G. (2014). *Social skills of children and adolescents: Conceptualization, assessment, treatment*: Psychology Press.
Merry, S., Stasiak, K., Parkin, A., Seymour, F., Lambie, I., Crengle, S., & Pasene-Mizziebo, E. (2004). *Child and Youth Outcome Measures: Examining current use and acceptability of measures in mental health services and recommending future directions*: Health Research Council of New Zealand Auckland.
Ministry of Health. (2005). *A Review of Neonatal Intensive Care Provision in New Zealand:February 2004*. Accessed online 29th August 2011, from http://www.moh.govt.nz.
Mize, J. (2005). Social skills intervention and peer relationship difficulties in early childhood: Comments on Bierman and Erath, Manz and McWayne, and Odom. *Encyclopedia on Early Childhood Development [online]. Montreal, Quebec: Centre of Excellence for*, 1-7.
Moster, D., Lie, R. T., & Markestad, T. (2008). Long-term medical and social consequences of preterm birth. *New England Journal of Medicine, 359*(3), 262-273.
Mulder, H., Pitchford, N. J., Hagger, M. S., & Marlow, N. (2009). Development of executive function and attention in preterm children: a systematic review. *Developmental neuropsychology, 34*(4), 393-421.
Muscara, F., Catroppa, C., & Anderson, V. (2008). Social problem-solving skills as a mediator between executive function and long-term social outcome following paediatric traumatic brain injury. *Journal of neuropsychology, 2*(2), 445-461.
Myers, D. G., & Diener, E. (1995). Who is happy? *Psychological science, 6*(1), 10-19.
Mykletun, A., Stordal, E., & Dahl, A. A. (2001). Hospital Anxiety and Depression (HAD) scale: factor structure, item analyses and internal consistency in a large population. *The British journal of psychiatry, 179*(6), 540-544.
Mynard, H., & Joseph, S. (2000). Development of the multidimensional peer-victimization scale. *Aggressive Behavior, 26*(2), 169-178. doi: Doi 10.1002/(Sici)1098-2337(2000)26:2<169::Aid-Ab3>3.0.Co;2-A
Nadeau, L., Boivin, M., Tessier, R., Lefebvre, F., & Robaey, P. (2001). Mediators of behavioral problems in 7-year-old children born after 24 to 28 weeks of gestation. *J Dev Behav Pediatr, 22*(1), 1-10.
Nadeau, L., Tessier, R., Lefebvre, F., & Robaey, P. (2004). Victimization: a newly recognized outcome of prematurity. [Research Support, Non-U.S. Gov't]. *Dev Med Child Neurol, 46*(8), 508-513.
Nassau, J. H., & Drotar, D. (1997). Social competence among children with central nervous system-related chronic health conditions: a review. *J Pediatr Psychol, 22*(6), 771-793.

Ogilvy, C. (1994). Social skills training with children and adolescents: a review of the evidence on effectiveness. *Educational Psychology, 14*(1), 73-83.
Orpinas, P., & Horne, A. M. (2006). *Bullying prevention: Creating a positive school climate and developing social competence*: American Psychological Association.
Orpinas, P., Raczynski, K., Peters, J. W., Colman, L., & Bandalos, D. (2014). Latent Profile Analysis of Sixth Graders Based on Teacher Ratings: Association With School Dropout.
Palisano, R., & Galuppi, B. (1999). *Gross motor function classification system for cerebral palsy*: CanChild Centre for Childhood Disability Research.
Pallant, J. (2013). *SPSS survival manual*: McGraw-Hill Education (UK).
Parker, J. G., & Asher, S. R. (1993a). Friendship and Friendship Quality in Middle Childhood - Links with Peer Group Acceptance and Feelings of Loneliness and Social Dissatisfaction. *Developmental Psychology, 29*(4), 611-621. doi: Doi 10.1037//0012-1649.29.4.611
Parker, J. G., & Asher, S. R. (1993b). Friendship and friendship quality in middle childhood: Links with peer group acceptance and feelings of loneliness and social dissatisfaction. *Developmental psychology, 29*(4), 611.
Perren, S., & Alsaker, F. D. (2006). Social behavior and peer relationships of victims, bully-victims, and bullies in kindergarten. *Journal of child psychology and psychiatry, 47*(1), 45-57.
Phillipsen, L. C., Bridges, S. K., McLemore, T. G., & Saponaro, L. A. (1999). Perceptions of social behavior and peer acceptance in kindergarten. *Journal of Research in Childhood Education, 14*(1), 68-77.
Pierrat, V., Marchand-Martin, L., Guemas, I., Matis, J., Burguet, A., Picaud, J. C., . . . Roze, J. C. (2011). Height at 2 and 5 years of age in children born very preterm: the EPIPAGE study. *Archives of Disease in Childhood-Fetal and Neonatal Edition*, fetalneonatal185470.
Pope, A. W., & Ward, J. (1997). Self-perceived facial appearance and psychosocial adjustment in preadolescents with craniofacial anomalies. *The Cleft palate-craniofacial journal, 34*(5), 396-401.
Pritchard, V., Clark, C., Liberty, K., Champion, P., Wilson, K., & Woodward, L. (2009). Early school-based learning difficulties in children born very preterm. *Early human development, 85*(4), 215-224.
Pritchard, V. E., Bora, S., Austin, N. C., Levin, K. J., & Woodward, L. J. (2014). Identifying very preterm children at educational risk using a school readiness framework. *Pediatrics, 134*(3), e825-e832.
Puhl, R. M., & King, K. M. (2013). Weight discrimination and bullying. *Best Pract Res Clin Endocrinol Metab, 27*(2), 117-127. doi: 10.1016/j.beem.2012.12.002
Raino, S. S. (2008). *Factor structure on social competence based upon the perceptions of school psychologists*: ProQuest.
Rantanen, K., Eriksson, K., & Nieminen, P. (2012). Social competence in children with epilepsy--a review. *Epilepsy Behav, 24*(3), 295-303. doi: 10.1016/j.yebeh.2012.04.117
Raver, C. C., & Zigler, E. F. (1997). Social competence: An untapped dimension in evaluating Head Start's success. *Early childhood research quarterly, 12*(4), 363-385.
Rawlins, W. K. (1992). *Friendship matters: Communication, dialectics, and the life course*: Transaction Publishers.
Reijneveld, S. A., de Kleine, M. J., van Baar, A. L., Kollée, L. A., Verhaak, C. M., Verhulst, F. C., & Verloove-Vanhorick, S. P. (2006a). Behavioural and emotional problems in very preterm and very low birthweight infants at age 5 years. *Arch Dis Child Fetal Neonatal Ed, 91*(6), F423-428. doi: 10.1136/adc.2006.093674
Reijneveld, S. A., De Kleine, M. J. K., van Baar, A. L., Kollée, L. A. A., Verhaak, C. M., Verhulst, F. C., & Verloove-Vanhorick, S. P. (2006b). Behavioural and emotional problems in very preterm and very low birthweight infants at age 5 years. *Archives of Disease in Childhood-Fetal and Neonatal Edition, 91*(6), F423-F428.
Reijntjes, A., Kamphuis, J. H., Prinzie, P., Boelen, P. A., van der Schoot, M., & Telch, M. J. (2011). Prospective linkages between peer victimization and externalizing problems in children: a meta-analysis. *Aggress Behav, 37*(3), 215-222. doi: 10.1002/ab.20374
Research, A. C. f. E. (1984). *School Life Questionnaire*. Camberwell, VIC.

Restiffe, A. P., & Gherpelli, J. L. D. (2006). Comparison of chronological and corrected ages in the gross motor assessment of low-risk preterm infants during the first year of life. *Arquivos de neuro-psiquiatria, 64*(2B), 418-425.

Rigby, K. (2008). *Children and bullying : how parents and educators can reduce bullying at school*. Malden, MA ; Oxford: Blackwell Pub.

Ritchie, K., Bora, S., & Woodward, L. (2015). Social development of children born very preterm: a systematic review. *Developmental Medicine & Child Neurology*.

Rogers, C. E., Anderson, P. J., Thompson, D. K., Kidokoro, H., Wallendorf, M., Treyvaud, K., . . . Inder, T. E. (2012). Regional cerebral development at term relates to school-age social–emotional development in very preterm children. *Journal of the American Academy of Child & Adolescent Psychiatry, 51*(2), 181-191.

Rose-Krasnor, L. (1997). The nature of social competence: A theoretical review. *Social development, 6*(1), 111-135.

Rubin, K. H., Coplan, R. J., & Bowker, J. C. (2009). Social withdrawal in childhood. *Annual review of psychology, 60*, 141.

Rubin, K. H., & Rose-Krasnor, L. (1992). Interpersonal problem solving and social competence in children *Handbook of social development* (pp. 283-323): Springer.

Rubin, K. H., Wojslawowicz, J. C., Rose-Krasnor, L., Booth-LaForce, C., & Burgess, K. B. (2006). The best friendships of shy/withdrawn children: Prevalence, stability, and relationship quality. *Journal of abnormal child psychology, 34*(2), 139-153.

Rucklidge, J. J. (2008). Gender differences in ADHD: implications for psychosocial treatments.

Rudolph, K. D., Hammen, C., & Burge, D. (1995). Cognitive representations of self, family, and peers in school-age children: links with social competence and sociometric status. *Child Dev, 66*(5), 1385-1402.

Rueger, S. Y., & Jenkins, L. N. (2014). Effects of peer victimization on psychological and academic adjustment in early adolescence. *School Psychology Quarterly, 29*(1), 77.

Saigal, S., & Doyle, L. W. (2008). An overview of mortality and sequelae of preterm birth from infancy to adulthood. *Lancet, 371*(9608), 261-269. doi: 10.1016/S0140-6736(08)60136-1

Saigal, S., Pinelli, J., Hoult, L., Kim, M., & Boyle, M. (2003). Psychopathology and social competencies of adolescents who were extremely low birth weight. *Pediatrics, 111*(5), 969-975.

Saigal, S., Stoskopf, B., Boyle, M., Paneth, N., Pinelli, J., Streiner, D., & Goddeeris, J. (2007). Comparison of current health, functional limitations, and health care use of young adults who were born with extremely low birth weight and normal birth weight. *Pediatrics, 119*(3), E562-E573. doi: DOI 10.1542/peds.2006-2328

Salmon, K., Dittman, C., Sanders, M., Burson, R., & Hammington, J. (2014). Does adding an emotion component enhance the Triple P− Positive Parenting Program? *Journal of Family Psychology, 28*(2), 244.

Samara, M., Marlow, N., & Wolke, D. (2008). Pervasive behavior problems at 6 years of age in a total-population sample of children born at≤ 25 weeks of gestation. *Pediatrics, 122*(3), 562-573.

Samara, M., Marlow, N., Wolke, D., & Group, E. S. (2008). Pervasive behavior problems at 6 years of age in a total-population sample of children born at </= 25 weeks of gestation. *Pediatrics, 122*(3), 562-573. doi: 10.1542/peds.2007-3231

Sameroff, A. J., Seifer, R., Barocas, R., Zax, M., & Greenspan, S. (1987). Intelligence quotient scores of 4-year-old children: Social-environmental risk factors. *Pediatrics, 79*(3), 343-350.

Sanders, M. R., Kirby, J. N., Tellegen, C. L., & Day, J. J. (2014). The Triple P-Positive Parenting Program: A systematic review and meta-analysis of a multi-level system of parenting support. *Clinical psychology review, 34*(4), 337-357.

Sansavini, A., Guarini, A., Alessandroni, R., Faldella, G., Giovanelli, G., & Salvioli, G. (2006). Early relations between lexical and grammatical development in very immature Italian preterms. *Journal of Child Language, 33*(01), 199-216.

Sansavini, A., Guarini, A., Justice, L. M., Savini, S., Broccoli, S., Alessandroni, R., & Faldella, G. (2010). Does preterm birth increase a child's risk for language impairment? *Early human development, 86*(12), 765-772.

Sarnaik, A. P., Daphtary, K., & Sarnaik, A. A. (2005). Ethical issues in pediatric intensive care in developing countries: combining western technology and eastern wisdom. *Indian J Pediatr, 72*(4), 339-342.

Sattler, J. M. (2008). *Assessment of children: Cognitive foundations*: JM Sattler.

Scott, M. N., Taylor, H. G., Fristad, M. A., Klein, N., Espy, K. A., Minich, N., & Hack, M. (2012). Behavior disorders in extremely preterm/extremely low birth weight children in kindergarten. [Peer Reviewed]. *Journal of Developmental and Behavioral Pediatrics, .33*(3), pp. doi: 10.1097/DBP.0b013e3182475287 22245934

Semrud-Clikeman, M. (2007). *Social competence in children*: Springer.

Shields, A., & Cicchetti, D. (1997). Emotion regulation among school-age children: the development and validation of a new criterion Q-sort scale. *Developmental psychology, 33*(6), 906.

Smith, L. K., Draper, E. S., Manktelow, B. N., Dorling, J. S., & Field, D. J. (2007). Socioeconomic inequalities in very preterm birth rates. *Archives of Disease in Childhood-Fetal and Neonatal Edition, 92*(1), F11-F14.

Solaski, M., Majnemer, A., & Oskoui, M. (2014). Contribution of socio-economic status on the prevalence of cerebral palsy: a systematic search and review. *Dev Med Child Neurol, 56*(11), 1043-1051. doi: 10.1111/dmcn.12456

Soria-Pastor, S., Padilla, N., Zubiaurre-Elorza, L., Ibarretxe-Bilbao, N., Botet, F., Costas-Moragas, C., . . . Junque, C. (2009). Decreased Regional Brain Volume and Cognitive Impairment in Preterm Children at Low Risk. *Pediatrics, 124*(6), E1161-E1170. doi: DOI 10.1542/peds.2009-0244

Sperling, M. B., & Berman, W. H. (1994). *Attachment in adults: Clinical and developmental perspectives*: Guilford Press.

Spittle, A. J., Treyvaud, K., Doyle, L. W., Roberts, G., Lee, K. J., Inder, T. E., . . . Anderson, P. J. (2009a). Early emergence of behavior and social-emotional problems in very preterm infants. *J Am Acad Child Adolesc Psychiatry, 48*(9), 909-918. doi: 10.1097/CHI.0b013e3181af8235

Spittle, A. J., Treyvaud, K., Doyle, L. W., Roberts, G., Lee, K. J., Inder, T. E., . . . Anderson, P. J. (2009b). Early emergence of behavior and social-emotional problems in very preterm infants. [Peer Reviewed]. *Journal of the American Academy of Child & Adolescent Psychiatry, .48*(9), pp. doi: 10.1097/CHI.0b013e3181af8235 19633579

Stevenson, A. (2010). *Oxford dictionary of English*: Oxford University Press.

Stoll, B. J., Hansen, N. I., Bell, E. F., Shankaran, S., Laptook, A. R., Walsh, M. C., . . . Human Development Neonatal Research, N. (2010). Neonatal outcomes of extremely preterm infants from the NICHD Neonatal Research Network. *Pediatrics, 126*(3), 443-456. doi: 10.1542/peds.2009-2959

Stump, K. N., Ratliff, J. M., Wu, Y. P., & Hawley, P. H. (2009). Theories of social competence from the top-down to the bottom-up: A case for considering foundational human needs *Social behavior and skills in children* (pp. 23-37): Springer.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics*: Pearson Education Limited.

Taylor, H. G., Klein, N., Drotar, D., Schluchter, M., & Hack, M. (2006). Consequences and risks of <1000-g birth weight for neuropsychological skills, achievement, and adaptive functioning. *J Dev Behav Pediatr, 27*(6), 459-469.

Theunissen, N. C., Veen, S., Fekkes, M., Koopman, H. M., Zwinderman, K. A., Brugman, E., & Wit, J. M. (2001). Quality of life in preschool children born preterm. *Dev Med Child Neurol, 43*(7), 460-465.

Treyvaud, K. (2014). Best practice when using the Strengths and Difficulties Questionnaire with extremely preterm children: are two informants better than one? *Developmental Medicine & Child Neurology, 56*(5), 413-414.

Treyvaud, K., Doyle, L. W., Lee, K. J., Roberts, G., Lim, J., Inder, T. E., & Anderson, P. J. (2012). Social-Emotional Difficulties in Very Preterm and Term 2 Year Olds Predict Specific Social-Emotional Problems at the Age of 5 Years. *Journal of Pediatric Psychology, 37*(7), 779-785. doi: DOI 10.1093/jpepsy/jss042

Treyvaud, K., Inder, T. E., Lee, K. J., Northam, E. A., Doyle, L. W., & Anderson, P. J. (2012). Can the home environment promote resilience for children born very preterm in the context of social and medical risk? *Journal of experimental child psychology, 112*(3), 326-337.

Van Noort-Van Der Spek, I. L., Franken, M. C., & Weisglas-Kuperus, N. (2011). Language Functions in Preterm Children: A Systematic Review and Meta-Analysis. *Pediatric Research, 70*, 357-357.

Vederhus, B. J., Markestad, T., Eide, G. E., Graue, M., & Halvorsen, T. (2010a). Health related quality of life after extremely preterm birth: a matched controlled cohort study. *Health and Quality of Life Outcomes, 8*.

Vederhus, B. J., Markestad, T., Eide, G. E., Graue, M., & Halvorsen, T. (2010b). Research Health related quality of life after extremely preterm birth: a matched controlled cohort study.

Verlinden, M., Jansen, P. W., Veenstra, R., Jaddoe, V. W. V., Hofman, A., Verhulst, F. C., . . . Tiemeier, H. (2015). Preschool Attention-Deficit/Hyperactivity and Oppositional Defiant Problems as Antecedents of School Bullying. *Journal of the American Academy of Child & Adolescent Psychiatry*.

Vicari, S., Caravale, B., Carlesimo, G. A., Casadei, A. M., & Allemand, F. (2004). Spatial working memory deficits in children at ages 3-4 who were low birth weight, preterm infants. *Neuropsychology, 18*(4), 673.

Volpe, J. J. (2009). Brain injury in premature infants: a complex amalgam of destructive and developmental disturbances. *Lancet Neurology, 8*(1), 110-124. doi: Doi 10.1016/S1474-4422(08)70294-1

Wang, W., Vaillancourt, T., Brittain, H. L., McDougall, P., Krygsman, A., Smith, D., . . . Hymel, S. (2014). School climate, peer victimization, and academic achievement: Results from a multi-informant study. *School psychology quarterly, 29*(3), 360.

Waters, E., & Sroufe, L. A. (1983). Social competence as a developmental construct. *Developmental review, 3*(1), 79-97.

Webster-Stratton, C., & Reid, M. (2004a). Strengthening social and emotional competence in young children: The foundation for early school readiness and success: Incredible Years Classroom Social Skills and Problem-Solving curriculum. *Infants & Young Children, 17*(2), 96-113.

Webster-Stratton, C., & Reid, M. J. (2004b). Strengthening Social and Emotional Competence in Young Children—The Foundation for Early School Readiness and Success: Incredible Years Classroom Social Skills and Problem-Solving Curriculum. *Infants & Young Children, 17*(2), 96-113.

Weisglas-Kuperus, N., Baerts, W., Smrkovsky, M., & Sauer, P. J. (1993). Effects of biological and social factors on the cognitive development of very low birth weight children. *Pediatrics, 92*(5), 658-665.

Wiig, E. H., Secord, W., & Semel, E. M. (2004). *CELF preschool 2: clinical evaluation of language fundamentals preschool*: Pearson/PsychCorp.

Wilcox, A. J. (2001). On the importance--and the unimportance--of birthweight. *Int J Epidemiol, 30*(6), 1233-1241.

Wolke, D. (2011). Early term, preterm and post-term gestation births increase the risk of special educational needs during schooling. *Evid Based Ment Health, 14*(1), 11. doi: 10.1136/ebmh.14.1.11

Wolke, D. (2014). IS-034 The Health, Wealth And Social Relationships Of Ex Very Preterm/very Low Birth Weight (vp/vlbw) Children At 26 Years Of Age? The Bavarian Longitudinal Study (best, 1985–86 Cohort). *Archives of Disease in Childhood, 99*(Suppl 2), A11-A12.

Wolke, D., Baumann, N., Strauss, V., Johnson, S., & Marlow, N. (2015). Bullying of Preterm Children and Emotional Problems at School Age: Cross-Culturally Invariant Effects. *J Pediatr*. doi: 10.1016/j.jpeds.2015.02.055

Wolke, D., Samara, M., Bracewell, M., Marlow, N., & Group, E. P. S. (2008). Specific language difficulties and school achievement in children born at 25 weeks of gestation or less. *The Journal of pediatrics, 152*(2), 256-262. e251.

Wong, H. S., & Edwards, P. (2013). Nature or nurture: a systematic review of the effect of socio-economic status on the developmental and cognitive outcomes of children born preterm. *Matern Child Health J, 17*(9), 1689-1700. doi: 10.1007/s10995-012-1183-8

Wood, E., & Rosenbaum, P. (2000). The gross motor function classification system for cerebral palsy: a study of reliability and stability over time. *Developmental Medicine & Child Neurology, 42*(05), 292-296.

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). Woodcock-Johnson III.

Woodward, L., Clark, C., Bora, S., & Inder, T. (2012). Neonatal white matter abnormalities an important predictor of neurocognitive outcome for very preterm children. *PLoS One, 7*(12), e51879.

Woodward, L., & Fergusson, D. (1999). Childhood peer relationship problems and psychosocial adjustment in late adolescence. *J Abnorm Child Psychol, 27*(1), 87-104.

Woodward, L., & Fergusson, D. (2000). Childhood peer relationship problems and later risks of educational under-achievement and unemployment. *Journal of child psychology and Psychiatry, 41*(02), 191-201.

Woodward, L., Moor, S., Hood, K., Champion, P., Foster-Cohen, S., Inder, T., & Austin, N. (2009). Very preterm children show impairments across multiple neurodevelopmental domains by age 4 years. *Archives of Disease in Childhood-Fetal and Neonatal Edition, 94*(5), F339-F344. doi: DOI 10.1136/adc.2008.146282

Yau, G., Schluchter, M., Taylor, H. G., Margevicius, S., Forrest, C. B., Andreias, L., . . . Hack, M. (2013). Bullying of extremely low birth weight children: associated risk factors during adolescence. [Comparative Study

Research Support, N.I.H., Extramural]. *Early Hum Dev, 89*(5), 333-338. doi: 10.1016/j.earlhumdev.2012.11.004

Yeates, K. O., Bigler, E. D., Abildskov, T., Dennis, M., Gerhardt, C. A., Vannatta, K., . . . Taylor, H. G. (2014). Social competence in pediatric traumatic brain injury: From brain to behavior. [Peer Reviewed]. *Clinical Psychological Science, .2*(1), pp. doi: 10.1177/2167702613499734

Yeates, K. O., Bigler, E. D., Dennis, M., Gerhardt, C. A., Rubin, K. H., Stancin, T., . . . Vannatta, K. (2007). Social outcomes in childhood brain disorder: a heuristic integration of social neuroscience and developmental psychology. *Psychological bulletin, 133*(3), 535.

Yount, R. (2006). Correlation coefficients. *Yount, WR (4th Eds). Research Design and Statistical Analysis in Christian Ministry*, 22-21.

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta psychiatr scand, 67*(6), 361-370.

Zwierzynska, K., Wolke, D., & Lereya, T. S. (2013). Peer Victimization in Childhood and Internalizing Problems in Adolescence: A Prospective Longitudinal Study. *Journal of Abnormal Child Psychology, 41*(2), 309-323. doi: DOI 10.1007/s10802-012-9678-8

Appendix A

Table A.1: Study Quality Assessment Scale (Adapted from Bhutta et al.)[1]

Quality Parameters	Score		
	2	**1**	**0**
Population Sample	Defined geographic area	>1 hospital or regional	Convenience sample (1 hospital, not regional)
Study Design	Prospective longitudinal follow-up	Patients contacted after NICU discharge	Recruited at the time of assessment
Demographic Data†	Not applicable	Complete description	Inadequate
Socioeconomic Data‡	Not applicable	Adequate	Inadequate
Matching of cases and controls	>2 factors	1-2 factors	None
Specifically focused on social competence	Used a conceptual framework	Examined >2 aspects of social competence	Examined just one aspect of social competence

†Gestational age at birth, sex, race, or age at evaluation.
‡Family income, maternal education, paternal education, or socio-economic status.

Reference

1. Bhutta AT, Cleves MA, Casey PH, Cradock MM, Anand KJ. Cognitive and behavioural outcomes of school-aged children who were born preterm: a meta-analysis. *JAMA*. 2002;288(6):728-737.

Appendix B

Below are descriptions of a number of post-natal complications that preterm born children are at risk for. Although many of these complications can occur independent of preterm birth and not all preterm born infants will experience these complications, they can occur concurrently and have their own associated risks (such as increased risk of infection and hypoglycaemia) which may further impact short and long term on the development of a child born preterm. Therefore, it is important for researchers to outline the characteristics of their sample so readers know who the research can be generalised to.

Table B.1: Medical Complications Experienced by Preterm Born Children	
Intrauterine growth restriction(IUGR)	Some preterm born babies are born small for their gestational age due to Intrauterine Growth Restriction. The babies have restricted levels of growth within the womb which compromises their physical growth.
Postnatal dexamethasone use	Sometimes post-delivery preterm children are given dexamethasone (a corticosteroid) as a treatment for respiratory distress. Respiratory distress occurs in these preterm children (especially those born extremely preterm) because lung functions develop in the third trimester of pregnancy, so as these children are born earlier, they are born with underdeveloped lungs which are not prepared for breathing. For example, they do not have the pulmonary vascular structure and surfactant production which enables us to breathe. The use of dexamethasone has shown improvements in lung function in these tiny babies.
Intraventricular haemorrhage Grade III or IV	Intraventricular haemorrhage (IVH) is uncommon in Full-Term born infants and is mostly seen in those born prematurely. Again those who are born extremely preterm are at the highest risk of this complication. There are four grades of IVH with Grade III and IV being the most severe and includes distention of the ventricles and bleeding within the brain tissue which has been associated with neurological impairments.
Cystic periventricular leukomalacia	Periventricular leukomalacia (PVL) is a type of brain damage that leads to death and decay of injured white matter cells. This leaves empty areas in the brain which fill with fluid. This means that white matter cannot adequately send brain impulses through to the grey matter often resulting in impaired motor ability and Cerebral Palsy, as well as intellectual impairments.
Oxygen at 36 weeks	If an infant still requires oxygen at 36 weeks this means they are diagnosed with a significant lung condition called Bronchopulmonary dysplasia. They may need oxygen therapy for months or years. BPD was been associated with poor neurological outcome such as poorer language and motor ability.
Patent ductus arteriosus	Patent ductus arteriosus is a congenital heart condition which occurs after birth in some infants. The ductus arteriosus is meant to close up after birth in order to improve circulation and prevent oxygenated blood mixing with non-oxygenated blood. However, in PDA the ductus arteriosus remains open and this puts strain on the heart and also increases blood pressure in the infant's lung arteries.
Antenatal corticosteroid use	Corticosteroids are given to a mother expecting a preterm delivery as it has been shown to reduce the risk of preterm birth complications such as IVH, respiratory distress and even death.
Necrotising enterocolitis	Necrotising enterocolitis is a condition that infants born preterm are at risk for which affects their intestinal tract. It can occur on a continuum of severity with the most severe cases experiencing perforation of the bowel. This condition can be treated but has been associated with increased risk of neurodevelopmental disorders later in life.
Proven Sepsis	Sepsis is an infection that spreads via the bloodstream which can affect anyone. It is common in preterm born infants due to their weak immune system and risk factors include PDA, necrotising enterocolitis and BPD. Sepsis can lead to a number of complications such as poor growth and impaired neuro-development.

Appendix C

5 July 2010

Professor Lianne Woodward
Dept of Psychology
University of Canterbury
Private Bag 4800
Christchurch

Cc: Marie Goulden by email
Marie.Goulden@canterbury.ac.nz

Dear Professor Woodward

Ethics ref: **URA/10/05/040 (please quote this reference in all correspondence)**

Study title: **Neurological outcomes of children born very preterm at Age 12 years**

Investigators: Prof L Woodward, Dr V Pritchard, Dr N Austin, Dr R Watts, Dr T Inder

Localities: **Canterbury District Health Board, University of Canterbury**

This study was given ethical approval by the Upper South A Regional Ethics Committee on 5 July 2010.

Approved Documents

(Part 1)

- Parent's information sheet (preterm children) dated July 2010
- Preterm Children's information sheet dated July 2010
- Parent's information sheet and consent form dated July 2010
- Children's Information sheet and consent form dated July 2010
- Teacher's information sheet and consent form dated July 2010
- Parent/teacher contact details form dated July 2010

(Part 2)

- Parent's information sheet (preterm children) dated July 2010
- Preterm Children's information sheet dated July 2010
- Parent's information sheet and consent form dated July 2010
- Children's Information sheet and consent form dated July 2010
- Parent Interview
- Teacher Questionnaire

This approval is valid until **20 November 2013**, provided that Annual Progress Reports are submitted (see below).

Access to ACC

For the purposes of section 32 of the Accident Compensation Act 2001, the Committee is satisfied that this study is not being conducted principally for the benefit of the manufacturer or distributor of the medicine or item in respect of which the trial is being carried out. Participants injured as a result of treatment received in this trial will therefore be eligible to be considered for compensation in respect of those injuries under the ACC scheme.

Amendments and Protocol Deviations

All significant amendments to this proposal must receive prior approval from the Committee. Significant amendments include (but are not limited to) changes to:

- the researcher responsible for the conduct of the study at a study site
- the addition of an extra study site
- the design or duration of the study
- the method of recruitment
- information sheets and informed consent procedures.

Significant deviations from the approved protocol must be reported to the Committee as soon as possible.

Annual Progress Reports and Final Reports

The first Annual Progress Report for this study is due to the Committee by **July 2011**. The Annual Report Form that should be used is available at www.ethicscommittees.health.govt.nz. Please note that if you do not provide a progress report by this date, ethical approval may be withdrawn.

A Final Report is also required at the conclusion of the study. The Final Report Form is also available at www.ethicscommittees.health.govt.nz.

Requirements for the Reporting of Serious Adverse Events (SAEs)

For the purposes of the individual reporting of SAEs occurring in this study, the Committee is satisfied that the study's monitoring arrangements are appropriate.

SAEs occurring in this study must be individually reported to the Committee within 7-15 days only where they:

- are *unexpected* because they are not outlined in the investigator's brochure, and
- are not defined study end-points (e.g. death or hospitalisation), and
- occur in patients located in New Zealand, and
- if the study involves blinding, result in a decision to break the study code.

There is no requirement for the individual reporting to ethics committees of SAEs that do not meet all of these criteria. However, if your study is overseen by a data monitoring committee, copies of its letters of recommendation to the Principal Investigator should be forwarded to the Committee as soon as possible.

Please see www.ethicscommittees.health.govt.nz for more information on the reporting of SAEs, and to download the SAE Report Form.

We wish you all the best with your study.

Yours sincerely

Alieke Dierckx
Administrator, Upper South A Regional Ethics Committee
Email: alieke_dierckx@moh.govt.nz

15 November 2011

Professor Lianne Woodward
Dept of Psychology
University of Canterbury

Private Bag 4800
Christchurch

Attn: Kirsten Ritchie
kirsten.ritchie@pg.canterbury.ac.nz

Dear Professor Woodward

Ethics ref: **URA/10/05/040 (please quote this reference in all correspondence)**

Study title: **Neurological outcomes of children born very preterm at Age 12 years**

Investigators: Prof L Woodward, Dr V Pritchard, Dr N Austin, Dr R Watts, Dr T Inder

Localities: **Canterbury District Health Board, University of Canterbury**

Amendments

- Change existing measure of attention from Attention Network Task to 'TEACH'
- Incorporate additional measures of social competence (6 measures outlined)

Thank you for forwarding the request for the above amendments. This has been considered by one member and the Chairperson of the Upper South A Regional Ethics Committee, and approved under delegated authority.

Yours sincerely

Alieke Dierckx

Administrator

Upper South A Regional Ethics Committee

Uppersoutha_ethicscommittee@moh.govt.nz

Appendix D

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
Baseline Measures					
Highest SES in Household (2-Years Follow-up)	Mean		3.55	3.58	2.92
	95% Confidence Interval for Mean	Lower Bound	3.06	3.14	2.65
		Upper Bound	4.03	4.02	3.18
	5% Trimmed Mean		3.50	3.54	2.82
	Median		3.00	3.00	3.00
	Variance		2.53	2.89	1.89
	Std. Deviation		1.59	1.70	1.37
	Minimum		1	1	1
	Maximum		7	7	7
	Range		6	6	6
	Interquartile Range		3	3	2
	Skewness		.40	.30	.79
	Kurtosis		-.44	-.52	1.00
Maternal Age at Child Birth	Mean		30.72	30.65	31.07
	95% Confidence Interval for Mean	Lower Bound	28.85	29.34	30.23
		Upper Bound	32.59	31.95	31.91
	5% Trimmed Mean		30.93	30.79	31.14
	Median		31.50	31.00	32.00
	Variance		37.73	25.55	19.39
	Std. Deviation		6.14	5.05	4.40
	Minimum		16.00	19.00	19.00
	Maximum		41.00	39.00	45.00
	Range		25.00	20.00	26.00
	Interquartile Range		8.75	5.00	6.00
	Skewness		-.42	-.36	-.26
	Kurtosis		-.37	-.22	.81
12-year child characteristics					
Child Pubertal Development (Genitals)	Mean		2.52	2.30	2.36
	95% Confidence Interval for Mean	Lower Bound	2.26	2.10	2.22
		Upper Bound	2.78	2.50	2.50
	5% Trimmed Mean		2.53	2.28	2.37
	Median		3.00	2.00	2.00
	Variance		.72	.62	.52
	Std. Deviation		.84	.78	.72
	Minimum		1	1	1
	Maximum		4	4	4
	Range		3	3	3

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
	Interquartile Range		1	1	1
	Skewness		-.31	.05	-.22
	Kurtosis		-.47	-.42	-.46
Motor Ability (MABC Total Standard Score)	Mean		7.34	9.88	10.76
	95% Confidence Interval for Mean	Lower Bound	6.39	9.14	10.21
		Upper Bound	8.30	10.61	11.31
	5% Trimmed Mean		7.43	9.92	10.81
	Median		7.00	10.00	11.00
	Variance		9.18	7.82	8.39
	Std. Deviation		3.03	2.79	2.89
	Minimum		1	1	1
	Maximum		12	17	17
	Range		11	16	16
	Interquartile Range		5	4	4
	Skewness		-.32	-.37	-.38
	Kurtosis		-.74	1.29	.36
Gross Motor Function Classification System for Cerebral Palsy	Mean		.44	.29	.02
	95% Confidence Interval for Mean	Lower Bound	.15	.09	-.01
		Upper Bound	.73	.50	.05
	5% Trimmed Mean		.30	.16	.00
	Median		.00	.00	.00
	Variance		.85	.59	.02
	Std. Deviation		.92	.77	.14
	Minimum		0	0	0
	Maximum		4	4	1
	Range		4	4	1
	Interquartile Range		1	0	0
	Skewness		2.39	3.21	6.96
	Kurtosis		5.68	11.13	47.41
WISC-IV Full-Scale Estimated IQ	Mean		95.95	98.92	106.65
	95% Confidence Interval for Mean	Lower Bound	91.22	94.96	104.04
		Upper Bound	100.68	102.87	109.27
	5% Trimmed Mean		96.74	99.28	106.96
	Median		96.00	97.00	107.00
	Variance		224.69	234.04	189.72
	Std. Deviation		14.99	15.29	13.77
	Minimum		49	55	54
	Maximum		122	132	141
	Range		73	77	87
	Interquartile Range		18	19	16
	Skewness		-.65	-.23	-.44

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
	Kurtosis		1.44	.59	1.65
Number of Friends - Parent Report	Mean		.97	1.31	1.33
	95% Confidence Interval for Mean	Lower Bound	.82	1.19	1.23
		Upper Bound	1.13	1.43	1.42
	5% Trimmed Mean		.97	1.29	1.32
	Median		1.00	1.00	1.00
	Variance		.25	.22	.24
	Std. Deviation		.50	.46	.49
	Minimum		.00	1.00	.00
	Maximum		2.00	2.00	2.00
	Range		2.00	1.00	2.00
	Interquartile Range		.00	1.00	1.00
	Skewness		-.04	.80	.49
	Kurtosis		1.26	-1.39	-1.17
Number Friends - Child Report	Mean		1.20	1.45	1.40
	95% Confidence Interval for Mean	Lower Bound	1.04	1.31	1.30
		Upper Bound	1.35	1.59	1.51
	5% Trimmed Mean		1.22	1.47	1.42
	Median		1.00	1.00	1.00
	Variance		.26	.28	.30
	Std. Deviation		.50	.53	.54
	Minimum		.00	.00	.00
	Maximum		2.00	2.00	2.00
	Range		2.00	2.00	2.00
	Interquartile Range		.75	1.00	1.00
	Skewness		.32	-.17	-.14
	Kurtosis		.22	-1.22	-.96
Age of Best Friend	Mean		12.07	12.08	11.88
	95% Confidence Interval for Mean	Lower Bound	11.70	11.85	11.76
		Upper Bound	12.44	12.32	12.00
	5% Trimmed Mean		12.11	12.09	11.87
	Median		12.00	12.00	12.00
	Variance		1.43	.82	.36
	Std. Deviation		1.19	.90	.60
	Minimum		7	10	10
	Maximum		15	14	14
	Range		8	4	4
	Interquartile Range		1	2	0
	Skewness		-1.48	-.16	.06
	Kurtosis		7.33	-.46	1.44
Friendship duration	Mean		2.41	2.43	2.53

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
	95% Confidence Interval for Mean	Lower Bound	2.19	2.23	2.40
		Upper Bound	2.64	2.63	2.66
	5% Trimmed Mean		2.46	2.48	2.59
	Median		3.00	3.00	3.00
	Variance		.53	.58	.45
	Std. Deviation		.73	.76	.67
	Minimum		1.00	1.00	1.00
	Maximum		3.00	3.00	3.00
	Range		2.00	2.00	2.00
	Interquartile Range		1.00	1.00	1.00
	Skewness		-.85	-.93	-1.15
	Kurtosis		-.59	-.64	.08
Friendship Quality Questionnaire Total Score	Mean		18.12	17.29	17.50
	95% Confidence Interval for Mean	Lower Bound	17.10	16.30	16.76
		Upper Bound	19.15	18.28	18.24
	5% Trimmed Mean		18.30	17.48	17.66
	Median		18.66	18.28	18.20
	Variance		10.79	14.70	14.91
	Std. Deviation		3.28	3.83	3.86
	Minimum		8.48	5.63	7.31
	Maximum		23.43	24.00	23.48
	Range		14.95	18.37	16.17
	Interquartile Range		4.04	4.64	5.91
	Skewness		-.88	-.83	-.55
	Kurtosis		.97	.41	-.50
Frequency of Interaction – Parent Report	Mean		.81	.98	1.02
	95% Confidence Interval for Mean	Lower Bound	.66	.88	.95
		Upper Bound	.96	1.08	1.10
	5% Trimmed Mean		.80	.98	1.03
	Median		1.00	1.00	1.00
	Variance		.24	.15	.15
	Std. Deviation		.49	.39	.39
	Minimum		.00	.00	.00
	Maximum		2.00	2.00	2.00
	Range		2.00	2.00	2.00
	Interquartile Range		.00	.00	.00
	Skewness		-.39	-.16	.24
	Kurtosis		.52	4.08	3.59
Frequency of Interaction – Child Report	Mean		1.37	1.48	1.54
	95% Confidence Interval for Mean	Lower Bound	1.13	1.32	1.42
		Upper Bound	1.60	1.63	1.66
	5% Trimmed Mean		1.41	1.53	1.60

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
	Median		2.00	2.00	2.00
	Variance		.57	.35	.41
	Std. Deviation		.75	.59	.64
	Minimum		.00	.00	.00
	Maximum		2.00	2.00	2.00
	Range		2.00	2.00	2.00
	Interquartile Range		1.00	1.00	1.00
	Skewness		-.75	-.67	-1.12
	Kurtosis		-.82	-.46	.13
Peer Connectedness Scale	Mean		3.33	3.41	3.40
	95% Confidence Interval for Mean	Lower Bound	3.16	3.28	3.31
		Upper Bound	3.49	3.55	3.48
	5% Trimmed Mean		3.36	3.46	3.42
	Median		3.50	3.55	3.44
	Variance		.28	.25	.19
	Std. Deviation		.53	.50	.44
	Minimum		2.11	1.89	1.89
	Maximum		4.00	4.00	4.00
	Range		1.89	2.11	2.11
	Interquartile Range		.81	.61	.78
	Skewness		-.70	-1.07	-.54
	Kurtosis		-.51	.86	-.00
Frequency of Peer Victimization	Mean		2.38	1.93	1.91
	95% Confidence Interval for Mean	Lower Bound	1.92	1.57	1.69
		Upper Bound	2.84	2.30	2.12
	5% Trimmed Mean		2.31	1.81	1.80
	Median		2.00	1.00	2.00
	Variance		2.19	1.96	1.28
	Std. Deviation		1.48	1.40	1.13
	Minimum		1.00	1.00	1.00
	Maximum		5.00	5.00	5.00
	Range		4.00	4.00	4.00
	Interquartile Range		3.00	1.00	1.00
	Skewness		.72	1.33	1.25
	Kurtosis		-.99	.35	.66
How upset child was from peer victimization?	Mean		3.16	2.58	2.77
	95% Confidence Interval for Mean	Lower Bound	2.62	2.07	2.46
		Upper Bound	3.70	3.10	3.07
	5% Trimmed Mean		3.18	2.54	2.76
	Median		3.00	2.00	3.00
	Variance		1.72	1.47	1.20
	Std. Deviation		1.31	1.21	1.09

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
	Minimum		1	1	1
	Maximum		5	5	5
	Range		4	4	4
	Interquartile Range		2	2	2
	Skewness		-.19	.58	.01
	Kurtosis		-1.14	-.54	-.84
Parent Attachment – Alienation subscale	Mean		2.76	2.71	2.65
	95% Confidence Interval for Mean	Lower Bound	2.58	2.56	2.56
		Upper Bound	2.94	2.86	2.75
	5% Trimmed Mean		2.72	2.66	2.61
	Median		2.71	2.57	2.42
	Variance		.32	.34	.26
	Std. Deviation		.57	.58	.51
	Minimum		1.86	2.14	2.00
	Maximum		4.71	4.86	4.00
	Range		2.86	2.71	2.00
	Interquartile Range		.89	1.00	.57
	Skewness		.97	1.16	1.07
	Kurtosis		1.59	1.58	.30
Parent Attachment – Trust Subscale	Mean		3.52	3.35	3.39
	95% Confidence Interval for Mean	Lower Bound	3.36	3.23	3.32
		Upper Bound	3.67	3.46	3.48
	5% Trimmed Mean		3.50	3.35	3.39
	Median		3.50	3.33	3.33
	Variance		.24	.19	.16
	Std. Deviation		.49	.44	.40
	Minimum		2.33	2.11	2.33
	Maximum		5.00	4.78	4.78
	Range		2.67	2.67	2.44
	Interquartile Range		.44	.56	.44
	Skewness		.66	-.08	.50
	Kurtosis		1.57	2.20	1.23
Parent Attachment – Communication Subscale	Mean		3.47	3.59	3.52
	95% Confidence Interval for Mean	Lower Bound	3.35	3.47	3.46
		Upper Bound	3.60	3.70	3.60
	5% Trimmed Mean		3.50	3.59	3.53
	Median		3.66	3.66	3.55
	Variance		.16	.20	.13
	Std. Deviation		.40	.45	.37
	Minimum		1.89	2.22	2.56
	Maximum		4.11	4.89	4.56
	Range		2.22	2.67	2.00

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
	Interquartile Range		.44	.44	.33
	Skewness		-1.55	-.03	-.23
	Kurtosis		4.72	2.02	.97
Parent Attachment – Total Score	Mean		4.23	4.22	4.27
	95% Confidence Interval for Mean	Lower Bound	3.98	3.99	4.12
		Upper Bound	4.48	4.45	4.42
	5% Trimmed Mean		4.26	4.26	4.29
	Median		4.42	4.41	4.42
	Variance		.64	.77	.62
	Std. Deviation		.80	.87	.79
	Minimum		2.43	1.56	1.89
	Maximum		5.46	6.30	6.35
	Range		3.03	4.75	4.46
	Interquartile Range		1.39	1.11	.91
	Skewness		-.52	-.76	-.55
	Kurtosis		-.52	1.17	.53
Friend Attachment – Alienation Subscale	Mean		1.89	1.99	1.91
	95% Confidence Interval for Mean	Lower Bound	1.62	1.83	1.81
		Upper Bound	2.16	2.15	2.02
	5% Trimmed Mean		1.79	1.97	1.88
	Median		1.57	2.00	1.85
	Variance		.75	.38	.30
	Std. Deviation		.86	.62	.54
	Minimum		1.00	1.00	1.00
	Maximum		5.00	3.86	3.86
	Range		4.00	2.86	2.86
	Interquartile Range		1.04	.71	.71
	Skewness		1.71	.51	1.04
	Kurtosis		3.66	.21	1.69
Friend Attachment – Trust Subscale	Mean		4.55	4.51	4.46
	95% Confidence Interval for Mean	Lower Bound	4.32	4.34	4.33
		Upper Bound	4.77	4.67	4.58
	5% Trimmed Mean		4.66	4.58	4.53
	Median		4.77	4.77	4.66
	Variance		.52	.39	.41
	Std. Deviation		.72	.62	.64
	Minimum		1.44	2.00	1.56
	Maximum		5.00	5.00	5.00
	Range		3.56	3.00	3.44
	Interquartile Range		.58	.78	.89
	Skewness		-2.77	-1.89	-1.81

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
	Kurtosis		8.75	4.06	4.24
Friend Attachment – Communication Subscale	Mean		4.07	3.99	3.87
	95% Confidence Interval for Mean	Lower Bound	3.77	3.74	3.70
		Upper Bound	4.36	4.23	4.04
	5% Trimmed Mean		4.16	4.07	3.92
	Median		4.33	4.22	4.11
	Variance		.90	.88	.78
	Std. Deviation		.94	.94	.88
	Minimum		1.00	1.00	1.56
	Maximum		5.00	5.00	5.00
	Range		4.00	4.00	3.44
	Interquartile Range		1.33	1.22	1.42
	Skewness		-1.36	-1.16	-.66
	Kurtosis		1.75	1.19	-.36
Friend Attachment – Total Score	Mean		6.72	6.50	6.41
	95% Confidence Interval for Mean	Lower Bound	6.13	6.07	6.08
		Upper Bound	7.32	6.93	6.74
	5% Trimmed Mean		6.90	6.61	6.52
	Median		7.52	6.80	6.82
	Variance		3.69	2.72	3.05
	Std. Deviation		1.92	1.65	1.74
	Minimum		1.05	2.00	.70
	Maximum		9.00	8.86	9.00
	Range		7.95	6.86	8.30
	Interquartile Range		2.56	1.75	2.31
	Skewness		-1.26	-1.00	-.98
	Kurtosis		1.33	.54	.66
Anxious Rejection Sensitivity	Mean		6.22	5.77	6.30
	95% Confidence Interval for Mean	Lower Bound	5.03	5.01	5.75
		Upper Bound	7.42	6.54	6.85
	5% Trimmed Mean		5.89	5.55	6.15
	Median		5.16	5.33	6.08
	Variance		14.30	8.52	8.36
	Std. Deviation		3.78	2.91	2.89
	Minimum		2.00	1.17	1.00
	Maximum		17.17	16.67	17.17
	Range		15.17	15.50	16.17
	Interquartile Range		4.25	3.00	3.96
	Skewness		1.36	1.28	.83
	Kurtosis		1.53	2.65	1.60
Angry Rejection Sensitivity	Mean		5.30	4.08	4.72

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
	95% Confidence Interval for Mean	Lower Bound	4.27	3.61	4.27
		Upper Bound	6.33	4.55	5.17
	5% Trimmed Mean		5.09	4.03	4.55
	Median		4.83	3.50	4.16
	Variance		10.62	3.26	5.48
	Std. Deviation		3.25	1.80	2.34
	Minimum		1.67	1.00	1.00
	Maximum		13.33	8.33	13.33
	Range		11.66	7.33	12.33
	Interquartile Range		4.83	2.83	3.25
	Skewness		.87	.45	1.06
	Kurtosis		-.15	-.52	1.12
Teacher report Interpersonal skills composite	Mean		9.71	8.55	7.93
	95% Confidence Interval for Mean	Lower Bound	8.85	7.87	7.41
		Upper Bound	10.57	9.24	8.45
	5% Trimmed Mean		9.70	8.52	7.86
	Median		10.00	9.00	8.00
	Variance		7.67	6.97	7.25
	Std. Deviation		2.76	2.64	2.69
	Minimum		3.00	3.00	3.00
	Maximum		15.00	15.00	15.00
	Range		12.00	12.00	12.00
	Interquartile Range		5.00	3.00	3.00
	Skewness		-.12	.21	.25
	Kurtosis		-.48	-.11	.06
SDQ Peer Problems - Parent Report	Mean		2.84	1.20	1.20
	95% Confidence Interval for Mean	Lower Bound	2.08	.85	.90
		Upper Bound	3.59	1.54	1.49
	5% Trimmed Mean		2.68	1.07	1.02
	Median		2.00	1.00	1.00
	Variance		6.23	1.82	2.38
	Std. Deviation		2.49	1.35	1.54
	Minimum		.00	.00	.00
	Maximum		9.00	5.00	7.00
	Range		9.00	5.00	7.00
	Interquartile Range		3.00	2.00	2.00
	Skewness		.87	1.11	1.52
	Kurtosis		-.09	.73	2.25
SDQ Peer Problems - Teacher Report	Mean		3.18	1.72	1.51
	95% Confidence Interval for Mean	Lower Bound	2.37	1.31	1.13
		Upper Bound	3.99	2.14	1.89
	5% Trimmed Mean		3.09	1.62	1.27

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
	Median		3.00	2.00	1.00
	Variance		6.91	2.54	3.85
	Std. Deviation		2.63	1.59	1.96
	Minimum		.00	.00	.00
	Maximum		8.00	6.00	9.00
	Range		8.00	6.00	9.00
	Interquartile Range		4.00	3.00	2.00
	Skewness		.34	.70	1.62
	Kurtosis		-1.19	-.09	2.71
SDQ Prosocial Behaviour - Parent Report	Mean		8.22	8.55	8.56
	95% Confidence Interval for Mean	Lower Bound	7.48	8.16	8.27
		Upper Bound	8.97	8.93	8.86
	5% Trimmed Mean		8.51	8.66	8.69
	Median		9.00	9.00	9.00
	Variance		5.99	2.25	2.35
	Std. Deviation		2.44	1.50	1.53
	Minimum		1.00	4.00	3.00
	Maximum		10.00	10.00	10.00
	Range		9.00	6.00	7.00
	Interquartile Range		2.00	2.00	2.00
	Skewness		-1.66	-.98	-1.05
	Kurtosis		2.02	.39	.64
SDQ Prosocial Behaviour - Teacher Report	Mean		6.58	7.33	7.67
	95% Confidence Interval for Mean	Lower Bound	5.85	6.79	7.28
		Upper Bound	7.30	7.88	8.05
	5% Trimmed Mean		6.69	7.45	7.78
	Median		7.00	8.00	8.00
	Variance		5.58	4.43	4.05
	Std. Deviation		2.36	2.10	2.01
	Minimum		1.00	2.00	2.00
	Maximum		10.00	10.00	10.00
	Range		9.00	8.00	8.00
	Interquartile Range		3.00	3.00	3.00
	Skewness		-.52	-.48	-.67
	Kurtosis		.02	-.61	-.39
Combined Report SDQ Prosocial Behaviour	Mean		14.79	15.93	16.22
	95% Confidence Interval for Mean	Lower Bound	13.48	15.16	15.66
		Upper Bound	16.09	16.70	16.78
	5% Trimmed Mean		15.11	16.09	16.41
	Median		16.00	16.00	17.00
	Variance		17.97	8.68	8.42
	Std. Deviation		4.24	2.94	2.90

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
	Minimum		2.00	8.00	7.00
	Maximum		20.00	20.00	20.00
	Range		18.00	12.00	13.00
	Interquartile Range		5.00	4.00	4.00
	Skewness		-1.26	-.60	-.82
	Kurtosis		1.28	.13	.44
Combined Report SDQ Hyperactivity/Inattention	Mean		7.58	5.91	4.61
	95% Confidence Interval for Mean	Lower Bound	6.25	4.78	3.80
		Upper Bound	8.90	7.04	5.42
	5% Trimmed Mean		7.34	5.71	4.29
	Median		6.00	5.00	4.00
	Variance		18.53	18.70	17.91
	Std. Deviation		4.30	4.32	4.23
	Minimum		2.00	.00	.00
	Maximum		18.00	16.00	20.00
	Range		16.00	16.00	20.00
	Interquartile Range		6.00	5.00	6.00
	Skewness		.82	.49	1.01
	Kurtosis		-.17	-.47	.70
Combined Report SDQ Emotional Difficulties	Mean		5.20	4.06	3.34
	95% Confidence Interval for Mean	Lower Bound	4.08	3.34	2.78
		Upper Bound	6.33	4.79	3.90
	5% Trimmed Mean		5.04	3.88	3.12
	Median		5.00	4.00	3.00
	Variance		13.40	7.68	8.60
	Std. Deviation		3.66	2.77	2.93
	Minimum		.00	.00	.00
	Maximum		13.00	15.00	14.00
	Range		13.00	15.00	14.00
	Interquartile Range		6.00	4.00	4.00
	Skewness		.59	1.18	1.06
	Kurtosis		-.70	2.88	.89
Combined Report SDQ Conduct Problems	Mean		2.46	2.32	1.76
	95% Confidence Interval for Mean	Lower Bound	1.46	1.61	1.30
		Upper Bound	3.46	3.02	2.23
	5% Trimmed Mean		2.08	2.04	1.42
	Median		1.00	1.00	1.00
	Variance		10.49	7.29	5.91
	Std. Deviation		3.23	2.70	2.43
	Minimum		.00	.00	.00
	Maximum		16.00	10.00	12.00
	Range		16.00	10.00	12.00

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group					
			EPT	VPT	FT
	Interquartile Range		4.00	3.00	2.00
	Skewness		2.13	1.54	2.25
	Kurtosis		6.09	1.60	5.70
WJ-III Math Fluency Standard Score	Mean		87.54	92.72	100.07
	95% Confidence Interval for Mean	Lower Bound	81.96	88.55	96.86
		Upper Bound	93.11	96.89	103.27
	5% Trimmed Mean		87.08	92.44	100.41
	Median		84.00	93.50	101.00
	Variance		312.20	260.68	279.83
	Std. Deviation		17.66	16.14	16.72
	Minimum		51	59	51
	Maximum		132	143	144
	Range		81	84	93
	Interquartile Range		24	20	23
	Skewness		.33	.26	-.37
	Kurtosis		-.17	.67	.04
4 year child characteristics					
Full Scale IQ Score	Mean		93.86	95.40	104.75
	95% Confidence Interval for Mean	Lower Bound	88.45	91.77	102.14
		Upper Bound	99.26	99.02	107.35
	5% Trimmed Mean		94.58	95.85	105.24
	Median		94.00	96.00	106.00
	Variance		308.83	197.43	181.41
	Std. Deviation		17.57	14.05	13.46
	Minimum		44.00	54.00	52.00
	Maximum		126.00	121.00	138.00
	Range		82.00	67.00	86.00
	Interquartile Range		15.00	18.50	17.00
	Skewness		-.68	-.42	-.68
	Kurtosis		1.07	.23	1.73
WPPSI Total verbal Performance	Mean		18.12	18.32	20.48
	95% Confidence Interval for Mean	Lower Bound	16.28	17.05	19.56
		Upper Bound	19.96	19.59	21.40
	5% Trimmed Mean		18.11	18.41	20.56
	Median		18.00	18.50	21.00
	Variance		34.01	24.11	22.27
	Std. Deviation		5.83	4.91	4.71
	Minimum		7	5	5
	Maximum		30	31	33
	Range		23	26	28
	Interquartile Range		6	7	6

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
	Skewness		-.14	-.16	-.30
	Kurtosis		-.08	.03	.60
Total Emotional Regulation Score	Mean		15.00	15.57	16.59
	95% Confidence Interval for Mean	Lower Bound	14.01	14.67	15.96
		Upper Bound	15.98	16.48	17.22
	5% Trimmed Mean		15.18	15.86	16.88
	Median		16.00	16.00	17.00
	Variance		10.33	11.71	10.61
	Std. Deviation		3.21	3.42	3.25
	Minimum		6.00	5.00	6.00
	Maximum		20.00	20.00	20.00
	Range		14.00	15.00	14.00
	Interquartile Range		4.00	4.00	4.00
	Skewness		-.83	-1.20	-1.11
	Kurtosis		.98	1.55	.97
Behavioural Inhibition Score	Mean		59.35	51.46	49.91
	95% Confidence Interval for Mean	Lower Bound	54.29	47.85	47.31
		Upper Bound	64.41	55.08	52.51
	5% Trimmed Mean		58.58	50.87	49.50
	Median		58.55	51.49	49.91
	Variance		270.36	189.34	180.84
	Std. Deviation		16.44	13.76	13.44
	Minimum		36.70	28.18	25.34
	Maximum		99.59	93.52	93.52
	Range		62.89	65.34	68.18
	Interquartile Range		28.41	19.89	18.03
	Skewness		.54	.64	.55
	Kurtosis		-.52	.35	.34
SDQ Parent hyperactivity/inattention problems score	Mean		4.41	3.51	2.88
(4 yrs)	95% Confidence Interval for Mean	Lower Bound	3.52	2.93	2.46
		Upper Bound	5.31	4.10	3.31
	5% Trimmed Mean		4.35	3.40	2.73
	Median		4.00	3.50	3.00
	Variance		8.44	4.92	4.81
	Std. Deviation		2.90	2.21	2.19
	Minimum		.00	.00	.00
	Maximum		10.00	10.00	10.00
	Range		10.00	10.00	10.00
	Interquartile Range		5.00	2.25	3.00
	Skewness		.36	.63	.89
	Kurtosis		-1.01	.61	.62

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
SDQ Parent emotional problems score (4 yrs)	Mean		2.34	1.79	1.40
	95% Confidence Interval for Mean	Lower Bound	1.77	1.34	1.14
		Upper Bound	2.92	2.24	1.67
	5% Trimmed Mean		2.25	1.62	1.28
	Median		2.00	1.00	1.00
	Variance		3.47	2.93	1.91
	Std. Deviation		1.86	1.71	1.38
	Minimum		.00	.00	.00
	Maximum		7.00	7.00	8.00
	Range		7.00	7.00	8.00
	Interquartile Range		2.00	2.25	2.00
	Skewness		.57	1.26	1.48
	Kurtosis		-.31	1.64	4.03
SDQ Parent prosocial behaviour score (4 yrs)	Mean		7.44	7.82	8.04
	95% Confidence Interval for Mean	Lower Bound	6.81	7.38	7.70
		Upper Bound	8.06	8.27	8.39
	5% Trimmed Mean		7.59	7.90	8.19
	Median		8.00	8.00	8.00
	Variance		4.15	2.84	3.20
	Std. Deviation		2.03	1.68	1.78
	Minimum		2.00	4.00	3.00
	Maximum		10.00	10.00	10.00
	Range		8.00	6.00	7.00
	Interquartile Range		3.00	3.00	2.00
	Skewness		-1.00	-.62	-.98
	Kurtosis		.80	-.63	.53
SDQ Parent conduct problems score (4 yrs)	Mean		2.81	2.60	2.20
	95% Confidence Interval for Mean	Lower Bound	2.07	2.10	1.86
		Upper Bound	3.55	3.10	2.55
	5% Trimmed Mean		2.65	2.48	2.13
	Median		2.00	2.00	2.00
	Variance		5.72	3.57	3.16
	Std. Deviation		2.39	1.89	1.77
	Minimum		.00	.00	.00
	Maximum		9.00	9.00	7.00
	Range		9.00	9.00	7.00
	Interquartile Range		3.00	3.00	2.00
	Skewness		.87	.84	.44
	Kurtosis		.19	1.22	-.66
SDQ Parent peer problems score (4 yrs)	Mean		2.27	1.18	1.15
	95% Confidence Interval for Mean	Lower Bound	1.64	.84	.87

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group					
			EPT	VPT	FT
		Upper Bound	2.91	1.53	1.43
	5% Trimmed Mean		2.09	1.08	.99
	Median		2.00	1.00	1.00
	Variance		4.25	1.73	2.09
	Std. Deviation		2.06	1.31	1.44
	Minimum		.00	.00	.00
	Maximum		9.00	5.00	6.00
	Range		9.00	5.00	6.00
	Interquartile Range		2.00	2.00	2.00
	Skewness		1.27	1.11	1.41
	Kurtosis		1.77	.46	1.66
SDQ Teacher peer problems score (4 yrs)	Mean		2.42	1.57	1.74
	95% Confidence Interval for Mean	Lower Bound	1.74	1.07	1.36
		Upper Bound	3.10	2.07	2.12
	5% Trimmed Mean		2.27	1.33	1.58
	Median		2.00	1.00	1.00
	Variance		4.55	3.48	3.77
	Std. Deviation		2.13	1.86	1.94
	Minimum		.00	.00	.00
	Maximum		8.00	8.00	7.00
	Range		8.00	8.00	7.00
	Interquartile Range		3.00	2.00	3.00
	Skewness		.79	1.82	1.00
	Kurtosis		-.07	3.67	-.00
4 year family characteristics					
Family Instability (0-4 years)	Mean		.29	.20	.13
	95% Confidence Interval for Mean	Lower Bound	.07	.04	.04
		Upper Bound	.51	.37	.22
	5% Trimmed Mean		.20	.09	.06
	Median		.00	.00	.00
	Variance		.39	.36	.16
	Std. Deviation		.62	.59	.40
	Minimum		.00	.00	.00
	Maximum		3.00	3.00	2.00
	Range		3.00	3.00	2.00
	Interquartile Range		.25	.00	.00
	Skewness		2.79	3.22	3.22
	Kurtosis		9.60	10.66	10.33
Parent Intrusiveness (2 and 4 years average)	Mean		1.58	1.38	1.29
	95% Confidence Interval for Mean	Lower Bound	1.33	1.25	1.21
		Upper Bound	1.83	1.51	1.38

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group

			EPT	VPT	FT
	5% Trimmed Mean		1.51	1.36	1.29
	Median		1.50	1.33	1.16
	Variance		.66	.24	.18
	Std. Deviation		.81	.49	.43
	Minimum		.50	.50	.50
	Maximum		4.67	3.33	2.33
	Range		4.17	2.83	1.83
	Interquartile Range		1.00	.50	.50
	Skewness		1.43	1.18	.46
	Kurtosis		3.68	3.34	-.19
Parental Supportiveness (2 and 4 year average)	Mean		3.19	3.45	3.61
	95% Confidence Interval for Mean	Lower Bound	2.91	3.21	3.46
		Upper Bound	3.47	3.69	3.77
	5% Trimmed Mean		3.20	3.50	3.67
	Median		3.33	3.66	3.66
	Variance		.80	.84	.66
	Std. Deviation		.89	.92	.81
	Minimum		1.34	1.34	1.34
	Maximum		4.83	4.83	5.00
	Range		3.50	3.50	3.67
	Interquartile Range		1.33	.83	1.17
	Skewness		-.40	-1.09	-.79
	Kurtosis		-.62	.14	.31
Parent-Child Synchrony (2 and 4 year average)	Mean		2.52	2.75	2.97
	95% Confidence Interval for Mean	Lower Bound	2.27	2.54	2.82
		Upper Bound	2.78	2.97	3.12
	5% Trimmed Mean		2.53	2.78	2.99
	Median		2.50	3.00	3.00
	Variance		.67	.68	.60
	Std. Deviation		.82	.82	.77
	Minimum		.84	1.00	1.00
	Maximum		4.00	4.17	4.33
	Range		3.17	3.17	3.33
	Interquartile Range		1.46	1.00	1.04
	Skewness		.06	-.59	-.46
	Kurtosis		-.77	-.47	-.58
Maternal Depression (2 and 4 year average)	Mean		8.89	9.22	8.81
	95% Confidence Interval for Mean	Lower Bound	7.15	7.94	7.83
		Upper Bound	10.62	10.50	9.78
	5% Trimmed Mean		8.68	9.11	8.58
	Median		8.50	8.00	8.00
	Variance		32.47	24.61	25.91

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group					
			EPT	**VPT**	**FT**
	Std. Deviation		5.69	4.96	5.09
	Minimum		0	0	0
	Maximum		23	23	28
	Range		23	23	28
	Interquartile Range		9	6	6
	Skewness		.57	.45	.78
	Kurtosis		-.47	-.02	1.12
Maternal Anxiety (2 and 4 year average)	Mean		10.57	9.82	8.94
	95% Confidence Interval for Mean	Lower Bound	8.73	8.51	7.92
		Upper Bound	12.41	11.12	9.95
	5% Trimmed Mean		10.43	9.70	8.63
	Median		10.00	9.00	8.00
	Variance		36.62	25.40	28.11
	Std. Deviation		6.05	5.04	5.30
	Minimum		0	1	0
	Maximum		25	21	34
	Range		25	20	34
	Interquartile Range		9	7	7
	Skewness		.49	.40	1.28
	Kurtosis		-.25	-.59	3.65
6 year child peer problems					
Parent SDQ Total Peer problems score	Mean		2.18	1.39	.88
	95% Confidence Interval for Mean	Lower Bound	1.49	.94	.62
		Upper Bound	2.88	1.84	1.14
	5% Trimmed Mean		2.01	1.25	.70
	Median		2.00	1.00	.00
	Variance		5.10	2.78	1.85
	Std. Deviation		2.25	1.66	1.36
	Minimum		.00	.00	.00
	Maximum		8.00	6.00	8.00
	Range		8.00	6.00	8.00
	Interquartile Range		3.00	2.00	1.00
	Skewness		1.09	1.19	2.33
	Kurtosis		.36	.43	7.20
SDQ Teacher Peer Problems	Mean		2.02	1.20	1.36
	95% Confidence Interval for Mean	Lower Bound	1.32	.74	1.02
		Upper Bound	2.72	1.65	1.71
	5% Trimmed Mean		1.80	.97	1.15
	Median		2.00	1.00	1.00
	Variance		4.79	2.83	3.11
	Std. Deviation		2.18	1.68	1.76

Table D.1 Descriptive Statistics for Variables Used in Thesis, Displayed for Each Gestational Group					
			EPT	**VPT**	**FT**
	Minimum		.00	.00	.00
	Maximum		8.00	7.00	10.00
	Range		8.00	7.00	10.00
	Interquartile Range		3.00	2.00	2.00
	Skewness		1.13	1.80	2.06
	Kurtosis		.99	3.09	6.11
9 year child peer problems					
Parent SDQ Total Peer problems score 9 yrs	Mean		2.43	1.61	1.54
	95% Confidence Interval for Mean	Lower Bound	1.73	1.14	1.22
		Upper Bound	3.12	2.07	1.86
	5% Trimmed Mean		2.26	1.39	1.34
	Median		2.00	1.00	1.00
	Variance		5.22	3.13	2.83
	Std. Deviation		2.28	1.77	1.68
	Minimum		.00	.00	.00
	Maximum		9.00	8.00	9.00
	Range		9.00	8.00	9.00
	Interquartile Range		3.75	2.00	2.00
	Skewness		.79	1.89	1.89
	Kurtosis		.00	4.35	5.04
Teacher SDQ Total Peer problems score 9 yrs	Mean		2.54	1.28	1.52
	95% Confidence Interval for Mean	Lower Bound	1.82	.85	1.17
		Upper Bound	3.26	1.70	1.87
	5% Trimmed Mean		2.33	1.12	1.34
	Median		2.00	1.00	1.00
	Variance		5.60	2.59	3.32
	Std. Deviation		2.36	1.61	1.82
	Minimum		.00	.00	.00
	Maximum		10.00	6.00	7.00
	Range		10.00	6.00	7.00
	Interquartile Range		3.00	2.00	3.00
	Skewness		1.08	1.22	1.16
	Kurtosis		1.16	.67	.51

Table D.1: Descriptive Statistics for Dichotomous Variables Used in Current Thesis				
		EPT	VPT	FT
	N	*n (%)*	*n(%)*	*n(%)*
Maternal Minority Ethnicity	212	8(18.2)	7(11.7)	13(12.0)
Single Parent	212	10 (22.7)	10 (16.7)	13(12.0)
Low Maternal Education	212	15 (34.1)	27 (45.0)	20 (18.5)
Hearing Problem	213	3 (6.8)	5 (8.3)	4 (3.7)
Vision Problem	213	19(43.2)	18 (30.0)	23 (21.1)
Low BMI 10th percentile	211	11 (25.6)	12 (20.3)	11 (10.1)
High BMI 10th percentile	211	3 (7.0)	4(6.8)	11 (10.1)
Participates in Team Sport	213	26 (59.1)	35 (58.3)	89(81.7)
Not satisfied with quantity of friends	207	7 (15.9)	1 (1.8)	1 (0.9)
Victimised at least once	209	26 (61.9)	24 (40.7)	57 (52.8)
Told someone about victimization	117	21 (75.0)	23 (85.2)	51 (82.3)
Experienced Physical Victimization	209	16 (38.1)	19 (32.2)	29 (26.9)
Experienced Property Victimization	209	17 (40.5)	17 (28.8)	36 (33.3)
Experienced Verbal Victimization	209	26 (61.9)	29 (49.2)	58 (53.7)
Experienced Social Manipulation Victimization	209	21 (50.0)	17 (28.8)	52 (48.1)
Child is a Bully Parent or Teacher Report	210	10 (23.3)	11 (18.3)	17 (15.9)
Child Report Being a Bully	209	22 (52.4)	19 (32.2)	51 (47.2)
Child Reported Being a Physical Bully	209	8 (19.0)	7 (11.9)	25 (23.1)
Child Reported Being a Property Bully	209	9 (21.4)	4 (6.8)	12 (11.1)
Child Reported Being a Verbal Bully	209	17 (40.5)	14 (23.7)	28 (25.9)
Child Reported Being a Social Manipulation Bully	209	15 (35.7)	11 (18.6)	29 (26.9)
Frequent Victimization Summary Variable	210	6 (14.3)	7 (11.9)	4 (3.7)
Peer Problem Summary Variable	208	23 (53.5)	13 (22.4)	24 (22.4)
Child has Health Concern	213	23 (52.3)	26 (43.3)	40 (36.7)
Language Problem at Age 4 years	205	12 (29.3)	17 (28.8)	12 (11.4)

Supplementary Table E.1: Bivariate Correlations Between Social Adjustment Outcomes, Peer Problems and Frequency of Victimization and Baseline Family and Concurrent 12-year Child Characteristics.

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1. Peer Connectedness	-.30**	-.31**	-.39**	.07	-.11	.06	.05	.06	-.02	-.05	.01	.06	.00	.00	.05	-.08	-.15*	.01	-.08	.02	-.01	.02	.17*	.12	.18*
2. SDQ Peer Problems 12-year Parent		.45**	.35**	.15*	-.03	.02	.08	.11	-.06	-.05	-.25**	-.06	.09	.07	.11	.30**	.33**	.22**	.31**	.34**	-.00	-.03	-.37**	-.24**	-.27**
3. SDQ Peer problems 12-year Teacher			.32**	.11	.08	-.07	-.02	.08	-.01	-.03	-.26**	-.10	-.05	.07	.04	.23**	.19**	.20**	.27**	.29**	-.10	-.12	-.23**	-.12	-.17*
4. Frequency Bullied				.15*	-.15*	.07	.03	.09	-.08	.01	-.07	-.01	.12	-.10	.08	.15*	.05	.04	.14*	.04	.04	.02	-.12	-.03	-.03
5. Socioeconomic Status					-.23**	.09	.15**	.32**	-.14*	-.09	-.19**	.06	.17*	-.04	.16*	.05	-.01	.03	-.03	.09	.01	.04	-.24**	-.19**	-.19**
6. Maternal Age at Child Birth						-.07	-.17*	-.18**	.11	.03	.02	.02	-.12	.11	-.08	.02	.14*	.07	.02	.00	-.13	-.11	.06	.07	.02
7. Maternal Ethnicity							.10	-.04	.11	.01	-.06	-.01	.10	-.06	.03	-.03	-.04	-.00	.12	-.03	.16*	.21**	-.06	.06	.02
8. Single Parent at Term Age								.10	-.07	-.07	-.11	.03	.06	-.08	-.05	-.06	.06	-.07	-.02	.13	.14*	.12	-.14*	-.12	-.15*
9. Maternal Education									.05	-.05	-.20**	-.02	-.08	.07	.03	.09	-.07	.11	.06	.14	.04	.03	-.30**	-.16*	-.17*
10. Twin Birth										.11	-.33**	-.01	-.20**	.12	-.06	.01	.05	.07	.13	.00	-.05	-.08	-.08	-.00	-.02
11. Number of siblings											.08	.13	-.20**	.04	-.07	-.06	.12	-.05	-.01	.01	-.10	-.15*	.05	.14*	.11
12. EPT, VPT, FT												-.06	.07	-.21**	-.02	-.19**	-.08	-.09	-.12	-.30**	-.05	-.04	.32**	.17*	.07
13. Sex													.01	.03	.05	.01	-.03	.06	-.11	-.11	-.06	.01	.01	.00	.17*
14. Body Mass Index (BMI)														-.49**	.62**	-.05	.04	-.05	.04	-.06	.40**	.41**	.06	.03	-.01
15. Low BMI															-.09	.08	.03	.07	.03	.01	-.35**	-.35**	-.06	-.03	.01
16. High BMI																-.02	.03	.04	.09	.06	.06	.06	-.06	.02	-.02
17. Child Vision Problem																	-.02	.73**	.17*	.22**	.05	-.01	-.23**	-.22**	-.15*
18. Hearing Problem																		.04	.08	.18*	-.01	-.02	-.18**	-.17*	-.17*
19. Child wears glasses																			.14*	.09	-.05	-.10	-.16*	-.13	-.08
20. Child Health Concern																				.17*	-.16*	-.15*	-.14*	-.01	-.09
21. Cerebral Palsy																					.06	.05	-.24**	-.25**	-.29**
22. Child Genitals																						.94**	.03	.00	.02
23. Child Pubic Hair																							.03	.03	.05
24. WISC-IV IQ																								.62**	.65**
25. WJ-III Letter Word Identification																									.64**

Supplementary Table E.1 continued: Bivariate Correlations Between Social Adjustment Outcomes, Peer Problems and Frequency of Victimization and Baseline Family and 12-year Child Characteristics.

		27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
1.	Peer Connectedness	.16*	.04	.16*	.20**	.29**	.15*	.17*	.21**	.11	.17*	.19**	.16*	.023	-.25**	-.19**	-.18*	.23**
2.	SDQ Peer Problems 12-year Parent	-.26**	-.27**	-.27**	-.34**	-.39**	-.35**	-.32**	-.37**	-.32**	-.40**	-.45**	-.46**	-.262**	.35**	.44**	.30**	-.23**
3.	SDQ Peer problems 12-year Teacher	-.20**	-.13	-.15*	-.34**	-.28**	-.30**	-.25**	-.32**	-.34**	-.40**	-.38**	-.45**	-.286**	.41**	.43**	.34**	-.34**
4.	Frequency Bullied	-.11	.01	-.05	-.16*	-.15*	-.12	-.13	-.16*	-.10	-.14*	-.20**	-.16*	-.133	.25**	.18*	.19**	-.10
5.	Socioeconomic Status	-.25**	-.16*	-.24**	-.21**	-.15*	-.22**	-.18*	-.22**	-.17*	.01	-.10	-.11	-.043	.20**	.06	.18*	-.14*
6.	Maternal Age at Child Birth	.10	.09	.08	.00	-.05	.08	.05	.02	-.00	-.11	-.12	-.07	.047	-.04	.07	-.04	-.10
7.	Maternal Ethnicity	-.01	-.02	.03	.00	.08	-.02	-.03	-.00	-.10	.00	.01	-.06	-.051	.08	.08	.20**	-.06
8.	Single Parent at Term Age	-.16*	-.09	-.15*	-.10	-.06	-.17*	-.16*	-.12	.06	-.04	-.03	.00	-.148*	.08	.02	.05	-.10
9.	Maternal Education	-.30**	-.20**	-.22**	-.25**	-.16*	-.32**	-.27**	-.29**	-.14*	.01	-.03	-.08	-.036	.19**	.16*	.07	-.08
10.	Twin Birth	.06	-.08	.00	-.10	-.11	-.07	-.09	-.11	-.09	-.07	-.02	-.08	-.020	-.04	.09	.11	.03
11.	Number of siblings	.13	.11	.13	.09	.05	.07	.13	.08	.12	-.02	.06	.09	.084	-.14*	-.09	-.03	.04
12.	EPT, VPT, FT	.010	.19**	.13	.34**	.31**	.34**	.31**	.38**	.32**	.29**	.31**	.37**	.237**	-.28**	-.23**	-.10	.12
13.	Sex	.06	.03	.07	.05	.03	.03	.03	.02	.05	-.18**	.11	-.01	-.141*	-.22**	.01	-.17*	.16*
14.	Body Mass Index (BMI)	-.03	.02	.00	.00	.10	.03	.07	.04	-.09	.03	-.21**	-.11	.009	.04	-.07	.12	.01
15.	Low BMI	.03	-.06	-.02	-.02	-.06	-.02	-.01	-.04	.03	-.15*	.5	-.03	-.069	.01	.10	-.01	.03
16.	High BMI	-.06	-.02	-.02	-.03	.02	-.03	-.04	-.03	-.07	-.06	-.28**	-.18*	-.024	.04	.09	.06	.00
17.	Child Vision Problem	-.18*	-.15*	-.17*	-.27**	-.25**	-.30**	-.30**	-.28**	-.33**	-.32**	-.27**	-.36**	-.074	.13	.23**	.08	.01
18.	Hearing Problem	-.19**	-.21**	-.17*	-.21**	-.19**	-.20**	-.17*	-.18*	-.21**	-.18**	-.26**	-.26**	-.065	.08	.05	.09	-.06
19.	Child wears glasses	-.14*	-.09	-.10	-.23**	-.21**	-.23**	-.20**	-.23**	-.29**	-.26**	-.26**	-.32**	-.039	.08	.19**	.07	.04
20.	Child Health Concern	-.07	-.04	-.05	-.12	-.18**	-.11	-.09	-.14*	-.17*	-.14*	-.19**	-.20**	-.118	.18*	.29**	.24**	-.12
21.	Cerebral Palsy	-.17*	-.28**	-.26**	-.25**	-.26**	-.27**	-.24**	-.28**	-.29**	-.33**	-.36**	-.36**	-.267**	.18*	.19**	.04	-.09
22.	Child Genitals	-.02	.02	.01	.02	.01	.07	-.02	.04	-.08	.06	-.05	-.04	.001	.07	-.05	.01	-.08
23.	Child Pubic Hair	-.01	.06	.03	.04	.02	.07	-.01	.05	-.07	.04	-.05	-.04	.007	.05	-.06	.03	-.08
24.	WISC-IV IQ	.70**	.52**	.74**	.76**	.61**	.80**	.76**	.81**	.46**	.29**	.37**	.44**	.144*	-.46**	-.34**	-.28**	.13
25.	WJ-III Letter Word Identification	.67**	.87**	.88**	.55**	.44**	.57**	.61**	.58**	.25**	.16*	.18**	.22**	.089	-.22**	-.19**	-.16*	.06
26.	WJ-III Reading Fluency	.68**	.58**	.88**	.48**	.56**	.56**	.55**	.58**	.34**	.12	.20**	.25**	.073	-.32**	-.23**	-.17*	.11
27.	WJ-III Passage Comprehension		.56**	.85**	.58**	.47**	.63**	.64**	.62**	.32**	.18*	.20**	.27**	.156*	-.34**	-.29**	-.22**	.15*
28.	WJ-III Word Attack			.77**	.49**	.34**	.48**	.54**	.49**	.27**	.17*	.19**	.23**	.103	-.21**	-.24**	-.15*	.06
29.	WJ-III Broad Reading Skills Standard Score				.59**	.54**	.64**	.66**	.66**	.32**	.14*	.20**	.25**	.104	-.31**	-.26**	-.19**	.10
30.	WJ-III Calculation					.70**	.83**	.81**	.95**	.44**	.36**	.38**	.47**	.199**	-.44**	-.36**	-.31**	.14*
31.	WJ-III Math Fluency						.67**	.66**	.82**	.38**	.36**	.30**	.40**	.23**	-.34**	-.30**	-.17*	.12
32.	WJ-III Applied Problems							.82**	.93**	.48**	.38**	.34**	.47**	.23**	-.39**	-.33**	-.24**	.11
33.	WJ-III Quantitative Concepts								.85**	.41**	.31**	.35**	.41**	.19**	-.42**	-.36**	-.25**	.14
34.	WJ-III Broad Maths Skills									.47**	.39**	.37**	.49**	.24**	-.42**	-.35**	-.26**	.12
35.	MABC Manual Dexterity										.51**	.47**	.84**	.25**	-.30**	-.28**	-.22**	.10
36.	MABC Aiming & Catching											.49**	.80**	.33**	-.19**	-.31**	-.10	.03
37.	MABC Balance												.739**	.19**	-.34**	-.24**	-.27**	.26**
38.	MABC Total Standard Score													.31**	-.32**	-.32**	-.23**	.14
39.	Team Sport Participation														-.13	-.22**	-.08	.16*
40.	Combined Report SDQ Hyperactivity															.39**	.55**	-.52**
41.	Combined Report SDQ Emotional																.26**	-.15*
42.	Combined Report SDQ Conduct																	-.43**
43.	Combined Report SDQ Prosocial																	

Appendix F

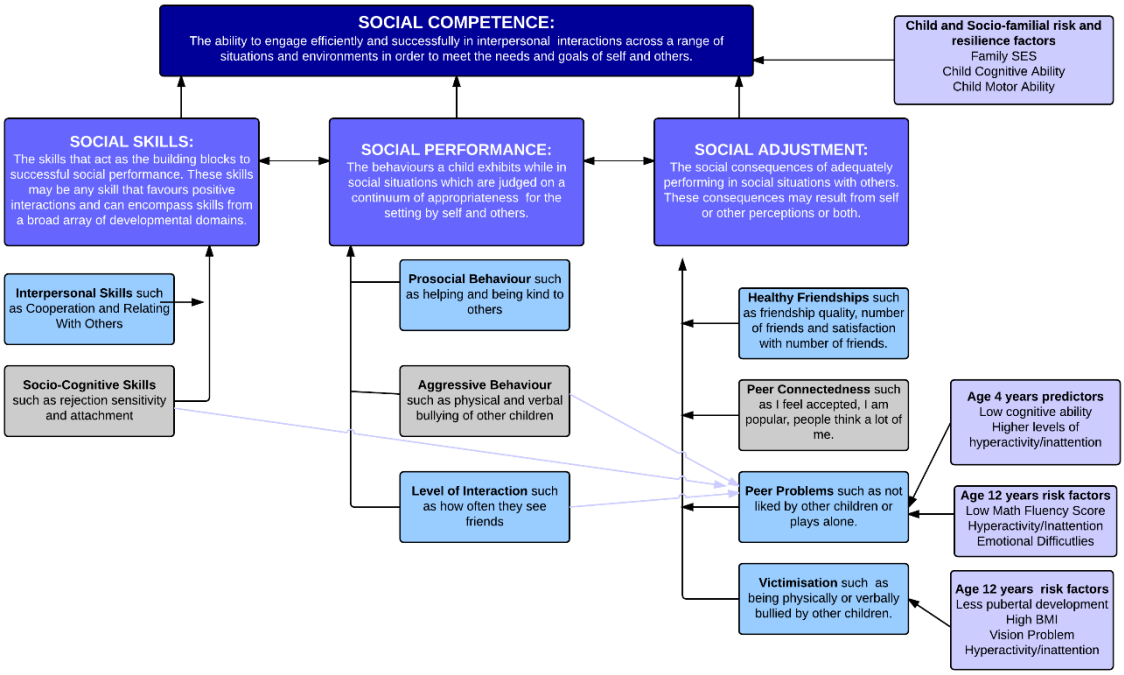

Figure F.1. Representation of results of thesis. Grey boxes represent sub-domains which did not differ between gestational groups. Blue boxes represent sub-domains which did differ between gestational groups. Purple boxes display associated risk factors of peer problems and victimization at age 12 years. Purple lines represent sub-domains which also were associated risk factors with peer problems and victimization at age 12 years.